

**THE STUDY ON
INTEGRATED MANGROVE MANAGEMENT
THROUGH COMMUNITY PARTICIPATION
IN
THE AYEYAWADY DELTA
IN
THE UNION OF MYANMAR**

Final Report
Volume II: Main Text



March 2005

Forest Department
Ministry of Forestry
The Union of Myanmar

Japan International
Cooperation Agency

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NIPPON KOEI CO.,LTD.

PREFACE

In response to a request from the Government of the Union of Myanmar, the Government of Japan decided to conduct The Study on Integrated Mangrove Management through Community Participation in the Ayeyawady Delta in the Union of Myanmar and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Yoichi Iwai of Nippon Koei Co., LTD. between February, 2002 and February, 2005.

The team held discussions with the officials of the Government of the Union of Myanmar 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 a friendly relationship between our two countries.

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

March 2005

Etsuo KITAHARA ,
Vice-President
Japan International Cooperation Agency

March 2005

Mr. Etsuo KITAHARA
Vice-President
Japan International Cooperation Agency

Letter of Transmittal

Dear Sir,

We are pleased to submit to your agency the Final Report on “The Study on Integrated Mangrove Management Through Community Participation in the Ayeyawady Delta in the Union of Myanmar”. This report presents the results of all the studies conducted in both Myanmar and Japan over a three-year period from February 2002 to March 2005.

The study formulated an integrated mangrove management plan (IMMP), with a total project period of 40 years starting from 2005 with the overall goal of establishing “coexistence of vivid mangrove vegetation and people’s lives” in the study area through the rehabilitation of degraded mangrove forests and livelihood improvement of the local people by various community forestry activities under the authorization of the Community Forestry Instruction . We believe that implementation of this holistic plan will contribute much to improve the natural environment and socio-economic situation in the study area.

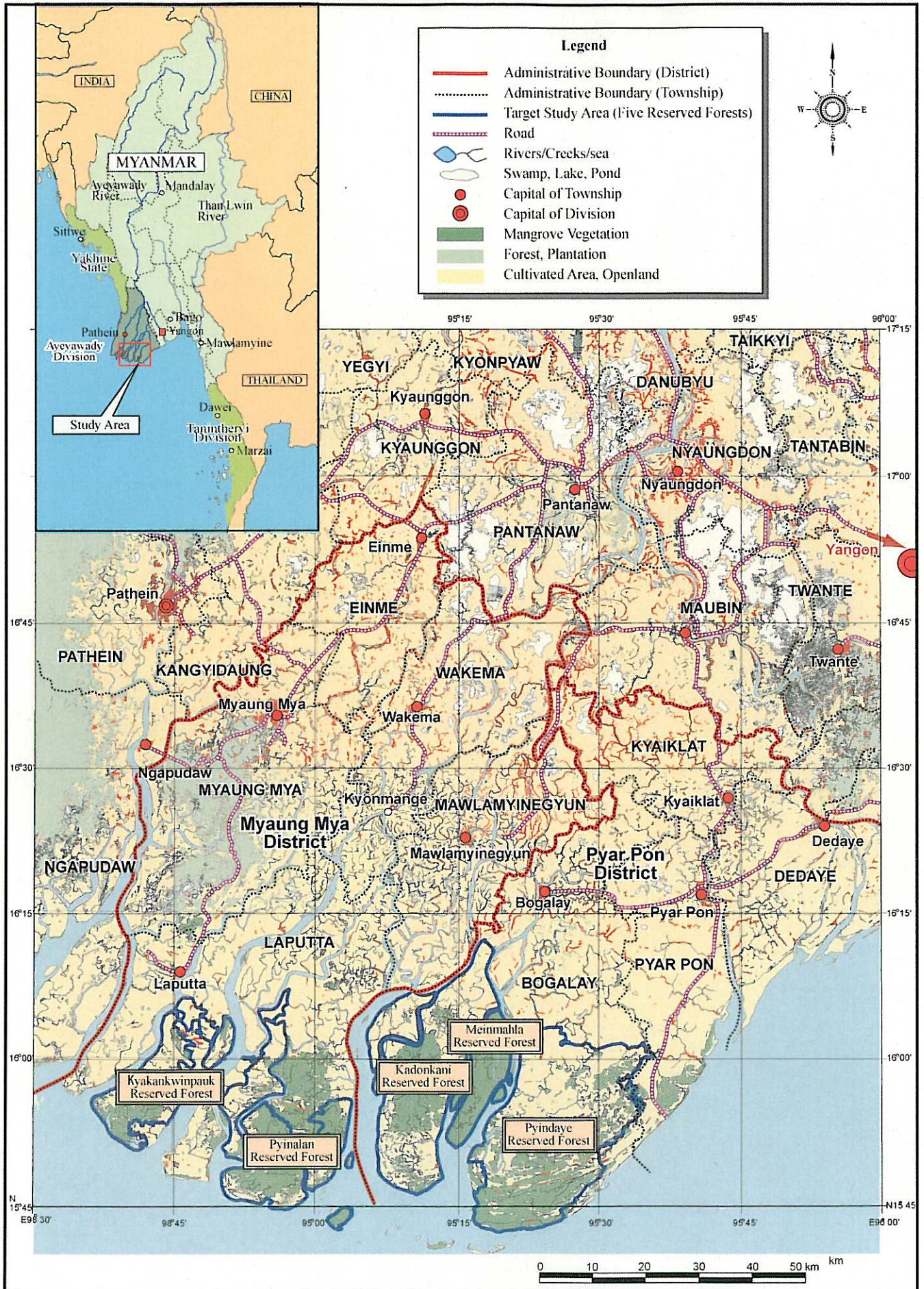
We, therefore, hope that the Myanmar government will soon commence implementing the integrated mangrove management plan and follow the implementation schedule presented in this report.

Finally, we wish to express our deep appreciation and sincere gratitude to your agency, the Advisory Committee, the Ministry of Agriculture, Forestry and Fisheries, the Embassy of Japan in Myanmar, the JICA Myanmar Office, and the Government of the Union of Myanmar for the close cooperation and assistance extended to us during our study.

Very truly yours,



Yoichi Iwai
Team Leader
The Study on Integrated Mangrove
Management through Community Participation
in the Ayeyawady Delta
Nippon Koei Co., LTD.



Location Map of Study Area

Exchange Rate: US\$1.00 = Myanmar Kyat 920 =Japanese Yen 108.47

(US\$-Myanmar Kyat: average market rate during the pilot project period:
February 2003 – October 2004)

(US\$-Japanese Yen: average of the mid-point rate of the end-of-month
from June – November 2004, Bank of Tokyo-Mitsubishi)

Note: Although official exchange rate is US\$1.00 = Myanmar Kyat 5.8 (Myanmar Foreign Trading
Bank, August 2004), the market rate above is used in this report.

Abbreviations

BUFFER	- Buffer Zone (Reserved Forest Zoning Category)
BSA	- Buffer Strip Area (Compartmental Operational Category)
CFDTC	- Central Forestry Development and Training Centre
CF	- Community Forestry
CFI	- Community Forestry Instruction
CMOA	- Closed Mangrove Forest Protection and Operation Area (Compartment Operational Category)
COMFORT	- Community Forestry Training and Extension Project in Dry Zone
CORE	- Core Zone (Reserved Forest Zoning Category)
DPDC	- District Peace and Development Council
FAO	- Food and Agricultural Organization
FD	- Forest Department
FREDA	- Forest Resource Environment Development and Conservation
GIS	- Geographic Information System
GPS	- Global Positioning System
HDI	- Human Development Initiative
IEE	- Initial Environmental Examination
IMMP	- Integrated Mangrove Management Plan
IRM	- Integrated Resource Management
JICA	- Japan International Cooperation Agency
MULTIPLE	- Multiple-use Zone (Reserved Forest Zoning Category)
MOA	- Multiple Operation Area (Compartment Operational Category)
NFIO	- Natural Forest Improvement Operation
NGO	- Non-Government Organization
NTFP	- Non Timber Forest Product
NWCD	- Nature and Wildlife Conservation Division
RRA	- Rapid Rural Appraisal
RIF	- Regeneration Improvement Felling
SLRD	- Settlement and Land Record Department
SMOA	- Sparse Mangrove Forest and Plantation Operation Area (Compartment Operational Category)
SPDC	- State Peace and Development Council
ToR	- Terms of Reference
TPDC	- Township Peace and Development Council
UNDP	- United Nations Development Program
UsG	- User's Group/User Group
VPDC	- Village Tract Peace and Development Council

Unit Conversion Table

Length:	1 foot = 0.305 m
	1 mile = 1.609 km
	1 chain = 66 feet = 20.13 m
Area:	1 ha (hectare) = 2.47 acres = 10,000 m ²
	1 acre = 0.405 ha = 4046.9 m ²
	1 sq mile = 640 acres = 2.59 km ²
Weight:	1 bkt (basket) of paddy* = 21 kg
	1 bag of rice** = 108 lbs (pounds) = 49 kg
	1 viss of (agricultural & aquatic products) = 3.6 lbs (pounds) = 1.64 kg
	1 pyi of rice** = 2 kg
Volume:	1 gallon = 4.546 ℓ
* paddy: unhulled, **rice: hull	

**THE STUDY ON
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THROUGH COMMUNITY PARTICIPATION
IN THE AYEYAWADY DELTA**

FINAL REPORT

VOLUME II: MAIN REPORT

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The Study on Integrated Mangrove Management
through Community Participation in the Ayeyawady Delta

Main Text

CHAPTER 1 SCOPE OF THE STUDY

1.1 Objectives of the Study

The Study on Integrated Mangrove Management through Community Participation in the Ayeyawady Delta (the Study) was started from February 2002 in accordance with the scope of work and minutes of meeting agreed between the Forest Department (FD) of the Ministry of Forestry and the Japan International Cooperation Agency (JICA). This Draft Final Report is prepared based on the results of all activities conducted in the Study.

The objectives of the study are as follows:

- 1) To formulate the Integrated Mangrove Management Plan (IMMP), which aims at rehabilitation and sustainable use of mangrove resources by local communities;
- 2) To implement the pilot project in order to confirm practicability of the IMMP and to enhance capacity building of the stakeholders; and
- 3) To transfer relevant technology to the Myanmar counterpart personnel through on-the-job training in the course of the Study.

1.2 Study Area

The study area covers the following five reserved forests in Bogalay and Laputta Townships in Ayeyawady Division with a total area of approximately 223,400 ha including water bodies. The area indicated in the following table is based on a calculation from the 2004 topographic map conducted by the Remote sensing and GIS sections in the planning and Statistic Division, FD.

Area of the Target Reserved Forests

Township	Reserved Forest	Area (ha)	Area (acre)
Laputta Township:	1. Kyakankwinpauk Reserved Forest	25,222	62,296
	2. Pyinalan Reserved Forest	38,966	96,246
Bogalay Township:	3. Kadonkani Reserved Forest	55,046	135,966
	4. Meinmahla Reserved Forest	13,224	32,663
	5. Pyindaye Reserved Forest	73,669	181,962
Total		206,127	509,133

Source: 2004 Topographic Map

1.3 Framework of the Study

The Study consists of Phase I (survey and formulation of the draft IMMP) and Phase II (implementation of pilot project and revision of the draft IMMP). The detailed activities of Phase I and II are summarized in Table 1.1.

1.4 Pilot Project

The planning of the pilot project was started in February 2003 in the selected areas of the Pyinalan Reserved Forest. Based on the agreement between FD and the selected community forestry (CF) user groups, the user group members were engaged in the preparatory works of the pilot project with FD. CF certificates were granted by FD in July 2003. Based on the progress of the planning activities of the pilot project in 2003 (the pilot project 2003), the selected subcontractor commenced the implementation of the pilot project in May 2003. Also, the capacity development of the frontline staff of FD was commenced as one of the components of the pilot project. A mid-term evaluation of the progress of the pilot project 2003 was conducted in October 2003 and a completion check also took place in January 2004. The results of the mid-term evaluation and the completion check were compiled in the field report and shared among the steering committee members in February 2004.

Although the pilot project 2003 was scheduled to be completed in February 2004, FD requested JICA to continue the pilot project with strong eagerness of the selected user groups. Responding to this earnest request, JICA accepted the continuation proposal as the pilot project 2004 in March 2004 (The pilot project up to February 2004 was named the pilot project 2003 to make distinction with the pilot project 2004). The pilot project 2004 for continuation of the pilot project 2003 was commenced in May 2004 scheduling for completion in October 2004.

The CF user groups and FD have been fully engaged in planning and drawing the CF management plan, implementation of the activities of the pilot project 2003 and 2004, and evaluation of their achievement in the mid-term and completion periods of the pilot project. The components of the pilot project 2003 and 2004 were selected by the stakeholders based on the proposal prepared by FD and the study team compiled in the draft IMMP.

Components of the Pilot Project 2003 and 2004

Pilot Project	Period	Major Component
Pilot Project 2003	Feb. 2003 – Feb. 2004	Planning, implementation and evaluation for: - Thar Yar Kone Village CF - Nyaung Ta Pin Village CF - The Forest Department Integrated Mangrove Nursery - The Forest Department Frontline Staff Capacity Development
Pilot Project 2004	May 2004 – Oct. 2004	Planning, implementation and evaluation for: - The Forest Department Capacity Development - Thar Yar Kone and Nyaung Ta Pin CF

1.5 Organization for the Study

(1) The FD Counterpart Personnel and the JICA Study Team

In order to carry out the Study effectively and efficiently, FD formulated a counterpart team and assigned its staff during the study period of Phase I and II. The following tables show the members of the FD counterpart personnel and the JICA Study Team.

Members of the FD Counterpart Personnel and the JICA Study Team (Phase I)

Position	the JICA study team	the FD Counterpart	Position in FD
1. Team Leader	Mr. Y. Iwai	U Tin Cho (chief counterpart)	Deputy director, PSD
2. Mangrove Conservation 1	Mr. D. Cabahug	U Kan Htun	RO, FD Bogalay
3. Mangrove Conservation 2/ Coordinator	Mr. T. Shibayama	- ditto -	
4. Fauna and Flora	Mr. S. Tanimoto	U Win Naing	RO, FD Laputta
5. Social Forestry Extension	Mr. S. Arai	U Thein Win	
6. Participatory Development	Ms. Y. Kitauchi	- ditto -	
7. Aquatic Resources and Development	Mr. K. Watabe	U Htun Htun Naing	
8. Socio-economy	Mr. N. Toyooka	U Kyaw Kyaw Naing	
9. GIS/ Land Cover	Mr. K. Sato	U Phone Htut	SO, PSD
10. Aerial Photograph Interpretation	Mr. I. Ikeshima	U Nuang Maung	SO, PSD

Members of the FD Counterpart Personnel and the JICA Study Team (Phase II)

Position	the JICA study team	the FD Counterpart	Position in FD
1. Team Leader	Mr. Y. Iwai	U Myint Swe (chief counterpart)	Deputy Director, PSD
2. Mangrove Conservation 1	Mr. D. Cabahug	U Win Naing	RO, FD Laputta
3. Mangrove Conservation 2/ Coordinator	Mr. T. Shibayama	- ditto -	
4. Social Forestry Extension	Mr. S. Arai	U Bo Ni	AD, PSD
5. Participatory Development	Ms. Y. Kitauchi	U Win Naing	RO, FD Laputta
6. Capacity development of forest department	Mr. A. Baba	U Toe Toe Aung	RO, PSD
7. Capacity development of user group and members	Mr. T. Saito	U Aung Ko Thet	RO, FD Laputta

(2) The FD Staff for Implementation of the Pilot Project

For implementation of the pilot project 2003 and 2004, FD assigned the following personnel mostly belonging to the Planning and Statistics Division in FD.

Members of the FD Personnel for Implementation of the Pilot Project

Name	Position in FD
1. U Soe Win Hlaing	Director General, Yangon (January 2004 -)
U Shwe Kyaw	Director General, Yangon (- January 2004)
2. U San Lwin	Director Planning and Statistics Division (PSD) , Yangon
3. U Myint Swe (chief counterpart)	Deputy Director, PSD, Yangon
4. U Bo Ni	Assistant Director, PSD, Yangon
5. U Win Myint	Director, FD Ayeyawady Division (May 2004 -)
U Khin Win	Director, FD Ayeyawady Division (- May 2004)
6. U Win Manug	Assistant Director, FD Ayeyawady Division and Ayeyawady District
7. U Win Myint	Assistant Director, FD Myaung Mya District
8. U Nyi Nyi	Staff Officer, FD Bogalay Township
9. U Soe Aung Than	Staff Officer, FD Laputta Township (May 2004 -)
U Tin Than Myo	Staff Officer, FD Laputta Township (- May 2004)
10. U Win Naing	Range Officer, Pyinalan Reserved forest, FD Laputta Township
11. U Aung Ko Thet	Range Officer, CF Task Force, FD Laputta Township
12. U Thein Win	Deputy Range Officer, Poelaung beat office No. 1, charged to Letwargyi FD camp
13. U Soe Lwin	Forester, Poelaung beat office No 3 charged to Thar Yar Kone Community Forestry including Thar Yar Kone Mangrove Nursery and forest compartment No 57 and 75
14. U Kyaw Moe Naing	Forester, Poelaung beat office No 2 charged to Nyaung Ta Pin Community Forestry and FD plantation at forest compartment No 59

The FD also collaborated on the pilot project activities with the regional offices and agencies in Myaung Mya District and Laputta Township for smooth and effective implementation of the pilot project, and for extension of the public awareness related to the mangrove conservation and rehabilitation. The regional offices and agencies that collaborated with FD are shown in the table below.

Regional Agencies that Collaborated with FD for Implementation of the Pilot Project

Myaung Mya District
- Peace and Development Council, Myaung Mya District
- Myanmar Agriculture Services, Myaung Mya
- Department of Fishery, Myaung Mya
- Department of Police, Myaung Mya
Laputta Township
- Peace and Development Council, Laputta Township
- Myanmar Agriculture Services, Laputta Township
- Department of Fishery, Laputta Township
- Department of Police, Laputta Township

(3) Steering Committee

In accordance with the Minutes of Meeting agreed between FD and JICA, FD established the steering committee for the Study. The committee consists of representatives of the FD of the Ministry of Forestry, the Myanmar Agriculture Services of the Ministry of Agriculture and Irrigation, and the Department of Fishery of the Ministry of Livestock and Fishery. The chairman of the committee is the Director General of FD.

(4) JICA Advisory Committee

JICA formulated the JICA advisory committee consisting of the following members for technical advice to JICA related to the Study.

The JICA Advisory Committee Members

	Name	Position in the Advisory Committee
(1)	Dr. Shozo NAKAMURA	Chairman
(2)	Ms. Ieko KAKUTA	Participatory Development

CHAPTER 2 PRESENT CONDITIONS IN THE STUDY AREA

2.1 Natural Condition in the Study Area

2.1.1 Topography, Geology and Soils

(1) Geology and Topography

The geological formation of the Ayeyawady Delta is relatively new and originates from the Cenozoic era. The majority of the delta, including the lower delta where the study area is located is of alluvial origin from the Holocene by the sedimentation action of the Ayeyawady River. However, the western central part of the delta, covering towns such as Patheingyi and Myaung Mya, is classified as the Ayeyawady Formation from the Miocene to the Pliocene. The parent material of the soils of the study area resulted mainly from recent sedimentation and bedrock formation of the area is immature.

The Ayeyawady Delta covers an area of 33,670km². Most of the lower delta areas are generally flat and the altitude is not more than 3m. However, there are also some low ridges with deciduous trees from the Myaung Mya Township running downward to the south, for about 50 km to the Laputta Township with numerous valleys intersecting Myaung Mya to Laputta. According to the Working Plan for the Delta Forest Division (FY1947/1948 to 1956/1957), a historical map of Myanmar shows that 500 years ago Myaung Mya was once an island in the sea, but recent studies indicate that seaward accretion is due to coastal erosive wave action. Surface run-off washed away the silt that was deposited once and resulted in accumulation forming another land formation. Such action has formulated the current landscape of the study area.

(2) River and Creek

The delta area has a large network of creeks, streams, and rivers, and is frequently flooded by tidal effects and/or rain during the rainy seasons. The land is intersected by rivers and creeks dividing it up into numerous islands. Basically, all of the rivers, creeks and channels are branched from the Ayeyawady River. The five reserved forests in the study area are intersected by the following major rivers in the north-south direction.

Major Rivers Intersecting Reserved Forests in the Study Area

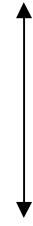
West	Reserved Forest	East
Ywe River	Kyakankwinpauk	Pya Ma Law River
Kakayan River, Pya Ma Law River (partial), Pyin Za Lu River	Pyinalan	Ayeyawady River
Ayeyawady River	Kadonkani	Kadonkani River
Kadonkani River	Meinmahla	Bogalay river
Bogalay River	Pyindaye	-

Source: 2004 Topographic Map

(3) Soil

The soil of Myanmar is classified into 24 main soil types by the Land Use Division of the Myanmar Agriculture Service. The soil of the study area is regarded as a mosaic of the following four soil types.

Soil Type of the Study Area

Soil Type	FAO/UNESCO Classification	Description	Frequency
Dune forest and beach sand	Arenosols	Coastal sandy soil featuring very weak or no soil development	High  Low
Saline swampy and Meadow gley soil	Gleyic Solonchaks	High salinity soil water logged and influenced by year round tidal sea water	
Mangrove forest soil	Thionic Fluvisols	Alluvial deposited soil with sulfidic material at less than 125 cm from the surface. Located at marine/brackish lowland flats affected by daily tides.	
Meadow gley / gley swampy Soil	Eutric Gleysols/ Humic Gleysols	Waterlogged soil showing hydromorphic properties within 50 cm of the surface	

Source: Country Profile Study on Environment (1999)

Pyarpon and Myaung Mya districts' forest management plans also indicate that the 2 districts have gleysol(s) soil, gleysol (humid) soil, solonchak (mangrove) soil and gleysol soils. However, detailed data are not available for the entire area covered in the district forest management plans. Generally, soil acidity can be experienced in mangrove areas. Soil acidity is also manifested in abandoned paddy fields. Thus it can have a negative effect on the yield of paddy rice.

Under the present study, a soil survey, that includes soil physical/chemical analysis, was conducted at the candidate pilot project sites located in the Pyinalan Reserved Forest. Based on the soil texture of topsoil/subsoil and other soil characteristics, soil mapping units were identified to represent the subtype of soils of the pilot project area. The units identified were 1) sandy alluvium deposited soil (high ground), 2) silty alluvium deposited soil (high ground) 3) tidal saline silty soil (medium ground) 4) tidal saline clayey soil (medium ground), and 5) saline swampy soil (low ground). Detail results of the soil survey will be compiled in the volume V: Data Book of the final report.

2.1.2 Meteorology and Hydrology

(1) Meteorology

There are three seasons recognized by the local people in Myanmar: rainy season ("Moe Yathi", from mid-May to mid-October), cold season ("Saung Yathi", from mid-October to mid-February) and dry (hot/summer) season ("New Yathi", from mid-February to mid-May). The seasonal change in the study area also follows this general pattern. Based on the data gathered in Myaung Mya Township, the temperatures in Bogalay and Laputta are ideal for mangrove growth. The recorded mean maximum temperature is 35-37 °C in March and April and the mean minimum temperature is 11-15 °C in December and January. Humidity is between 60 % and 100% throughout the year. The most highly evaporative

months are from March to mid-May with high temperature without rain. Tables 2.1 and Table 2.2 summarize climate conditions at Myaung Mya in Ayeyawady Division.

The recorded mean annual rainfalls (1998 to 2000) were; 2,477 mm in Bogalay Township and 3,354 mm in Laputta Township. Laputta Township tends to receive more rain than Bogalay Township and annual fluctuation is also higher. Rainfall of the two townships is described in Table 2.3.

(2) Tidal action

Tides are important natural occurrences for stability of the mangrove ecosystem and for determination of soil formation. During spring tides, most of the low lying and middle ground areas are inundated by saline and brackish water. When the tide is at its lowest level, the ground is relatively dry and only the low lying mangrove areas are inundated. Fishing is affected by the natural occurrence of tide, either on the highest or lowest level. Villagers have developed certain methods designed to cope with the type of tidal occurrence. For instance, fishing by bamboo sticks and nets floating from anchored bamboo rafts is done during low tide. The lunar month indicates the nature of the tide. Indication of the level of tides can be manifested by its periods, the waxing and waning days on Table 2.4.

- On waxing days (1-15 days), the tide rises at moonset
- On waning days (1-15 days), the tide rises at moonrise
- On the seventh waning day when the moon rises at midnight, the tide rises at moonrise
- On the thirteenth day (waxing/waning) tide rises at sunset or at daybreak

Tidal inundation can be classified by the level of increase and decrease of water on the following table.

Level of Water affected by Tidal Inundation.

Tidal Inundation	Water Level
Flooded by all high tides	0.1-1.7 m above admiralty datum (160 cm difference)
Flooded by medium high tides	1.7-2.0 m (30 cm difference)
Flooded by normal high tides	2.0 – 2.3 m (30 cm difference)
Flooded by spring high tides	2.3-2.6 m (30 cm difference)
Flooded by equinoctial tides	2.6-2.7 m (10 cm difference)
Flooded in rainy season	2.7 – 3.3 m (60 cm difference)

Source: Kogo M (1993)¹

Tidal ranges vary from area to area. Topographical conditions affect the tidal level. In Yangon, the mean spring tide range is wide at about 5.18 m as compared to other areas in Ayeyawady Division (1.74 m in Pathein and 1.98 m at Thamihla Island). Moreover, the volume of water brought about from rivers and creeks also affects tidal levels. During the rainy season, the level of water increases as the volume of rainwater increases, thereby increasing the level of water in rivers/creeks and streams.

¹ Kogo, M. 1993. Final Report on Mangrove Reforestation Feasibility Study”, Feasible Study on Mangrove Reforestation. MYA/90/003, Food and Agriculture Organization of the United Nations, Tokyo

Based on Kogo (1993)'s study, Pathein is observed to have a 1.2 – 1.6 m higher water level during the rainy season compared to the dry season. In most cases, tidal levels in the coastal areas are not necessarily affected by the discharge of freshwater or volume of rainfall even during the rainy season. Mangroves in the Ayeyawady Delta thrive best from 1.4 m to 2.6 m above sea level. It was also observed that mangroves do not thrive in areas lower than 1.4 m above sea level, where the seedlings are submerged for a long period of time. It is also not suitable for mangroves where there are shortages of water during the dry season. The study team also recognized growth patterns of mangroves similar to those observed by Kogo (1993).

(3) Salinity

The level of salinity is comparable and related to the distance of the area from the sea, topography, tidal action and rain. It is observed that water is less saline during rainy days, during low tide and where the distance from the sea is comparatively far. Measurement of salinity was carried out in the Ayeyawady river system in April 1991 during the dry season and July 1992 in the rainy season (Kogo 1993). The sea water salinity reading is presented in Table 2.5.

During the rainy season, the salinity level of rivers was around 1 ‰ throughout the research area. These can be considered as almost freshwater. But salinity conditions greatly changed in the dry season when there is less rain or no rain at all. During the dry season, a minimum salinity of 2 ‰ was observed at Pathein located more than 100 km from the river mouth. Salinity increased gradually towards the river mouth, and then the maximum salinity of 28 ‰ for this research area was observed at a point 25 km distance from the river mouth. The conditions, however, changed in Sarkyin creek, which is narrow but directly connected to the “28 ‰ salinity point”. Salinity decreased to 14 ‰ in the center of Sarkyin creek and finally dropped to 10‰ at Laputta town. Salinity level during the dry season increased gradually towards the sea.

(4) Soil Moisture

Brackish water is one of the determining factors and a prerequisite for the growth of mangrove stands. The rainy season provides both rainwater and tidal inundation even up to high ground areas. In contrast during the dry season, higher ground level mangrove areas suffer a deficit in water due to high evaporation, less tidal inundation and at the extreme, no rain at all. During the dry season, the study team has observed many cracks on the high ground of the study area, which are caused by desiccation.

According to Kogo (1993), during the dry season, in areas of high ground level, at low tide, the soil between 20-30 cm depth below the surface had no moisture. But soil moisture content appeared below 30cm depth and increased in the deeper part of the ground. The groundwater appeared at 150 cm depth. The ground water levels are related to the tide levels. However, soil water cannot rise to the ground surface during the dry season although the rate of evaporation is extremely high, because the volume increase of water level due to tidal inundation is not sufficient to push the ground water upward to reach the

level of the ground. The seasonal change of soil moisture at different ground levels is indicated in Table 2.6.

(5) Classification of Land and Implications for Mangrove Management

From the environmental factors, it is suggested that mangrove plantations in Ayeyawady Delta can possibly be classified with respect to the following aspects (Kogo, 1993):

- 1) Light conditions (effects of aggressive species that shade out undergrowth),
- 2) Soil moisture conditions during the dry season,
- 3) Ground level related to tidal inundation (low, medium, high, and extremely high ground level).

Land Classification Relating to Tidal Inundation

Ground Level	Frequency of flood per month in dry season	Flooded by	Watson's Inundation Class*
Low ground level	62-45	all high tides/medium high tides	1-2
Medium ground level	45-2	normal high tides/spring high	3-4
High ground level	4 times in dry season	equinoctial tide	5
Extremely high ground	0	only in rainy season	6

Note: Watson, J.P. 1928. Mangrove Forest of Malay Peninsula, Singapore, Fraser and Neave. (Malayan Forest Record, No. 6)

Source: Kogo, 1993

The ground level and tidal conditions critically influence the survival and the growth of the vegetation in mangrove forests. Therefore, understanding ground levels and tidal conditions of concerned sites is indispensable for proper mangrove forest management in the delta. Since the delta is relatively flat but with complex micro-scale topography, it is physically difficult to identify precise ground level and tidal condition of a given site. Therefore, the following approach should be taken to understand such natural conditions for further mangrove forest management in the delta.

- 1) Estimating ground levels based on existing and surrounding vegetation that normally corresponds with the ground level and the tidal condition of the area.
- 2) Regular measurement and recording of the tide level by FD camps. Though tidal conditions are empirically known to local residents and the FD staff, such knowledge is not well applied for establishing mangrove plantation or other forestry operations due to lack of evident data.
- 3) Developing mangrove gardens which imitate ground levels and corresponding vegetation.

2.1.3 Fauna and Flora

(1) Diversity in Fauna and Flora

Approximately 300 - 350 species of mammals, 1,000 species of birds, 300 - 360 species of reptiles, and 180 species of fish inhabit Myanmar. In terms of plant life, there are about 7,000 - 9,000 species of plants growing in Myanmar. It is estimated that the total number of

bio-species exceeds 20,000 in Myanmar, and of such one-fourth are regarded as endemic species of Myanmar.

Fauna and flora in the study area are mostly identified by literature records. Information is very limited and surveys had been conducted mostly in the Meinmahla Reserved Forest. Therefore, field surveys together with interviews with the local people were carried out to set up the current status of fauna and flora in the study area. The number of identified species in each taxonomical group is shown in the following table.

Number of Identified Species in each Taxonomical Group¹⁾

Taxonomical group	Family	Species	Important Wildlife ²⁾
Mammals	12	19	12
Birds	44	95	67
Reptiles	5	8	8
Plants	53	139	1

Note: 1) Each identified species is indicated in Tables 2.7 to 2.10

2) Refer to 2.1.3 (2) for important wildlife.

As for mammals, 12 families and 19 species are found (Table 2.7). The list includes many large-sized animals such as sambar deer (*Cervus unicolor*), and wild pig (*Sus scrofa*). Although there was no record about changes in mammalian numbers, they have decreased with reduction of mangrove forests according to the Forest Department (FD). Especially, most of the northern parts of reserved forests have been rapidly converted to farmlands in recent years and very few mammals have been observed in this area. On the other hand, the number of individuals of many species is increasing in the protected area of Meinmahla and Kadonkani Reserved Forests according to the FD staff.

As for birds, 44 families and 95 species are observed (Table 2.8). Little egret (*Egretta garzetta*) and herring gull (*Larus argentatus*) which are waterfowl, and common kingfisher (*Alcedo atthis*), buffy fish-owl (*Ketupa ketupu*) which prey on fish, are included. Although there is no record of the changes in the number of each species, they are increasing in the protected area according to the FD staff.

As for reptiles, 5 families and 8 species are recorded (Table 2.9). Detailed surveys of the estuarine crocodile (*Crocodylus porosus*) and marine turtles (*Leidochelys olivacea*, *Chelonia mydas*, *Caretta caretta*) were conducted by FD and the Wildlife Conservation Society in Myanmar. The number of crocodiles is estimated to be about 300 individuals in the study area. Most are located in the Meinmahla Reserved Forest. However, a small number can be found in Kyakankwinpauk, Kadonkani and Pyindaye Reserved Forests. Although the details of the changes in population are unknown, the population decreased from the beginning of the first half of the 1950s. In the Meinmahla Reserved Forest, starting from 1996, FD has been carrying out some conservation measures such as the collection of FD crocodiles, growing collected crocodiles at nurseries and releasing them into their habitats. Since then the crocodile population has been increasing. Mangrove terrapin (*Batagur baska*), and burmese roofed turtle (*Kachuga trivitatta*), species of

estuarine turtles, were distributed one hundred years ago. However, turtles decreased by edible extraction, and completely disappeared from the Ayeyawady Delta in the 1990s. Burmese eyed turtle (*Morenia ocellata*) inhabits irrigation ponds. In addition, marine turtles such as Loggerhead turtles (*Caretta caretta*) lay eggs along the seaside beaches of reserved forests and offshore islands.

As for plants, 53 families and 144 species are listed (Table 2.10). Common mangrove species such as *Rhizophora* spp. and *Sonneratia* spp. has been identified. Although the extent of mangrove forest was about 202,500 ha (500,000 acres) in Bogalay and Laputta townships in the early 1980s, it decreased to 40,500 ha (100,000 acres) or less by 1995. Among them, *Xylocarpus moluncensis*, *Sonneratia grifithii*, and *X. granatum* are decreasing remarkably. In order to promote reforestation, *Avicennia officinalis* and *Sonneratia apetala* were mainly planted in the 1990s. Their number has been increasing up to now. Moreover, fast growing species of *Phoenix paludosa* take place in the deforested mid to high ground level areas. An increased number of *Eriochloa procea* has been observed in the degraded area.

Although the literature about amphibians is very limited, 65 species of fish, 13 species of shrimp, and 4 species of crab have been recorded in the study area. It is known that 90 % of the marine organisms are passing one stage of their life cycle in mangrove forests. For this reason, a sharp decline of mangrove forests could cause a devastating effect on the organisms which, in turn, could lead to chaos with marine and estuarine ecosystems.

The fauna and flora shown in Tables 2.7 to 2.10 are species that have been recorded in the study area. Though decreases of population and species have been recorded, the study area is still rich in fauna and flora, and important habitats and wintering sites for such species.

(2) Important Wildlife

1) Important Wildlife Species

Important wildlife species can be identified as the threatened species which are ecologically and economically precious in the country. These species usually play a key role in any chain in their ecosystem. In addition, most tropical species are highly valued in bio-diversity. In this report, important wildlife species are determined based on “the Protected Animal List of the Myanmar” and “the Red List of the International Union for the Conservation of Nature and Natural Resources (IUCN)”. Totally 88 important species are identified as shown in Table 2.11. Macaque and otters listed in the table are indigenous in the mangrove environment in Myanmar. 67 birds listed in the table include many waterfowl and migratory birds for which habitats are endangered and decreasing in the world. As for important plants, only one species, *Intsia bijuga*, is listed.

2) Medicinal Plants

The native herbal and medicinal plants are shown in Table 2.12. In the delta area, many plants are used for medical treatment of detoxification, alleviation of fever, a skin disease, or toothache.

3) Bio-indicators and their Distribution

Out of the important wildlife species, the species which fulfills the following conditions are selected as a bio-indicator, and their distribution status was examined.

- Species representing the environment of the study area;
- Species which connect strongly with the natural environment of the study area; and
- Species for which it is easy to acquire information on their daily activities in the mangrove forests.

The selected species are shown in the following table and their distribution in Figure 2.1.

Bio-indicators in the Study Area

No.	Scientific Name	English Name	Habitat	Reason for Selection
1	<i>Macaca fascicularis</i>	Crab-eating Macaque	Forest along a river and the seashore	Interrelating with the natural environment
2	<i>Macaca mulatta</i>	Rhesus Macaque	Forest and forest edge	Interrelating with the natural environment
3	<i>Aonyx cinerea</i>	Small-clawed Otter	In or near water	Representing the natural environment
4	<i>Lutra perspicillata</i>	Smooth-coated Otter	In creeks, estuaries and coast	Representing the natural environment
5	<i>Cervus unicolor</i>	Sambar Deer	Forest, shrub	Representing the natural environment
6	<i>Elephas maximus</i>	Asiatic Elephant	Frequent high grass	Elephants in Kadonkani RESERVED FOREST are the variation/type which have adapted to mangrove areas. Their existence can be the symbol of mangrove conservation.
7	<i>Limosa limosa</i> <i>Tringa totarues, etc.</i>	Shore Birds	Coastal mudflats and sandy beaches	Representing the natural environment
8	<i>Crocodylus porosus</i>	Estuarine Crocodile	Riverbank in the mangroves	Interrelating with the natural environment
9	<i>Lepidochelys olivacea</i>	Olive Ridley	Shallow seabed of clay or sands	Representing the natural environment
10	<i>Chelonia mydas</i>	Green Turtle	Coral reefs	Representing the natural environment
11	<i>Caretta Caretta</i>	Loggerhead Turtle	Shallow seabed of clay or sands	Representing the natural environment

2.2 Land Use and Vegetation

2.2.1 Current Land Use

Based on the results of 2002 aerial photo interpretation conducted under the study, the current land use pattern of the study area is summarized in the following table and land use map of five reserved forests as shown in Figure 2.2. The land use categories described in the following table were compiled from identification keys decided for the aerial photo interpretation. The detail of the identification key is summarized in Table 2.13.

Cultivated land, which is composed mainly of paddy fields, is the dominant land use in the study area, occupying 97,261ha (approximately 47%) of the total study area, exceeding the total mangrove area of 90,386ha (approximately 44%). Also at reserved forest level, of the four reserved forests with cultivated land, the cultivated land is the dominant landscape in

all of the reserved forest except for the Pyinalan Reserved Forest where the mangrove forest occupies larger areas than the cultivated land by 1,190ha.

The Meinmahla Reserved Forest which is designated as a wildlife sanctuary has no existing settlements and cultivated land was significantly dominated by mangrove forests. Also it is noteworthy to mention that in Kyakankwinpauk, Pyinalan and Pyindaye reserved forests, there are saltpans and aquaculture ponds under the operation, which occupy, 774ha, 1,198ha and 418ha, respectively.

Land Use by Reserved Forest

Unit: ha

Land Use / Reserved Forest	Closed Mangrove Forest	Sparse Mangrove Forest	Plantation / Woodlot	Cultivated Land	Open / Barren Land	Saltpan / Fish Pond	Village/ Settlement	Mud flats	Total Area
Kyakankwinpauk	4,805	3,060	2,332	12,461	1,506	774	284	0	25,222
Pyinalan	7,234	9,498	27	15,542	3,743	1,198	1,460	264	38,966
Kadonkani	16,430	4,790	0	31,971	726	0	1,033	96	55,046
Meinmahla	13,150	0	0	0	34	0	0	40	13,224
Pyindaye	13,841	17,578	0	37,287	2,869	418	1,615	61	73,669
Total	55,460	34,926	2,359	97,261	8,878	2,390	4,392	461	206,127

Note: Plantation/wood lots may include FD plantation, CF plantations, nipa plantation, coconut plantation, and other woodlots, classified as artificial woody vegetations

Source: 2002 Aerial Photo Interpretation by GIS section FD

The remaining mangrove forest in the study area identified from the aerial photo interpretation is summarized in the following table. Except for the Meinmahla Reserved Forest which has nearly full forest cover, other reserved forests have only around 40 percent forest cover. According to the table, the Kyakankwinpauk Reserved Forest only has 31 percent forest cover. However, if including plantation/wood lot areas of 2,332 ha as forest vegetation, the forest cover of the Kyakankwinpauk Reserved Forest would also rise to 40 percent.

Mangrove Forest Areas in Reserved Forest

Unit: ha

Land Use Category / Reserved Forest	Mangrove Forest	(%)	Other Land Use	Total area
Kyakankwinpauk	7,865	31	17,357	25,222
Pyinalan	16,732	43	22,234	38,966
Kadonkani	21,220	39	33,826	55,046
Meinmahla	13,150	99	74	13,224
Pyindaye	31,419	43	42,250	73,669
Total	90,386	44	115,741	206,127

Source: 2002 Aerial Photo Interpretation by GIS section FD

2.2.2 Historical and Chorological Change

Although several data are available to identify the long-term trend in the change of land use in the delta, these sets were compiled from different sources of information with different classification categories except for the years 1995 through 2001 that were calculated based on Landsat images. Therefore, the change from 1995 to 2001 was considered for the analysis.

The table below shows the change of land use of the five reserved forests. During the 6 years from 1995 to 2001, mangrove areas decreased from 147,443 ha to 103,550 ha in the five reserved forests in total. The Pyindaye Reserved Forest lost its share of mangrove forest, down sharply from 75.1% to 44.1%, which is followed by the Kadonkani Reserved Forest with a loss of 21.3%. The Meinmahla Reserved Forest, designated as a protected area, still holds a good share of 88.9% forest. The Pyinalan Reserved Forest, with a decrease of 5.1 %, lost a relatively small portion of forests, compared to the other three reserved forests, namely the Pyindaye, Kadonkani, and Kyakankwinpauk Reserved Forests. On the other hand, cultivation areas have increased from 1995 to 2001 in all of the five reserved forests. As a whole, the cultivation area has nearly doubled from 25,328ha to 43,394ha during the six years.

Under current circumstances, all of the reserved forests, except for the Meinmahla Reserved Forest, have a tendency of continuous decrease in mangrove forest cover, and conversion to either cultivation areas or unproductive land. Without any countermeasures against the decrease of mangrove forest, the remaining mangrove forest in the reserved forests is speculated to diminish by 2013, under the current pace of destruction (approximately 8,800 ha/year).

Land Use Change by Reserved Forest

(Unit: ha)

Reserved Forest	Total Area	Mangrove		Kaing		Cultivation		Bamboo		Salt		Water	
		1995	2001	1995	2001	1995	2001	1995	2001	1995	2001	1995	2001
Kyakan kwinpauk	28,702	15,372	10,074	6,669	10,676	4,795	6,112	0	2	135	187	1,730	1,730
	100.0%	53.6%	35.1%	23.2%	37.2%	16.7%	21.3%	0.0%	0.0%	0.5%	0.7%	6.0%	6.0%
Pyinalan	43,517	28,008	25,475	8,782	8,761	2,430	5,156	17	27	344	0	3,936	3,936
	100.0%	64.4%	58.5%	20.2%	20.1%	5.6%	11.8%	0.0%	0.1%	0.8%	0.0%	9.0%	9.0%
Kadonkani	60,504	33,992	21,093	11,327	18,727	8,731	14,230	0	0	0	0	6,454	6,454
	100.0%	56.2%	34.9%	18.7%	31.0%	14.4%	23.5%	0.0%	0.0%	0.0%	0.0%	10.7%	10.7%
Meinmahla	13,670	12,338	12,269	149	91	104	231	0	0	0	0	1,078	1,078
	100.0%	90.3%	89.8%	1.1%	0.7%	0.8%	1.7%	0.0%	0.0%	0.0%	0.0%	7.9%	7.9%
Pyindaye	76,839	57,732	34,143	5,048	20,449	9,269	17,664	211	0	162	166	4,418	4,418
	100.0%	75.1%	44.4%	6.6%	26.6%	12.1%	23.0%	0.3%	0.0%	0.2%	0.2%	5.8%	5.8%
Total	223,232	147,443	103,054	31,976	58,703	25,328	43,394	228	29	642	353	17,616	17,616
	100.0%	66.0%	46.2%	14.3%	26.3%	11.3%	19.4%	0.1%	0.0%	0.3%	0.2%	7.9%	7.9%

Note: Kaing means "tall grasslands" in Myanmar

Source: Remote Sensing and Geographic Information System (GIS) Section, Forest Department (2001).
Establishing a database for 9 Ayeyawady Delta Forest Reserves.

Figure 2.3 is a thematic map that shows a spatial distribution of the percentage loss of forest in the year 2001 compared to the year 1995 by forest compartment. In the Kadonkani Reserved Forest, forest compartments with more than 30% decrease of forest cover can be observed in the northeastern and western area. In the Pyindaye Reserved Forest, forest compartments situated in the central part of the Reserved Forest have already lost their forest cover.

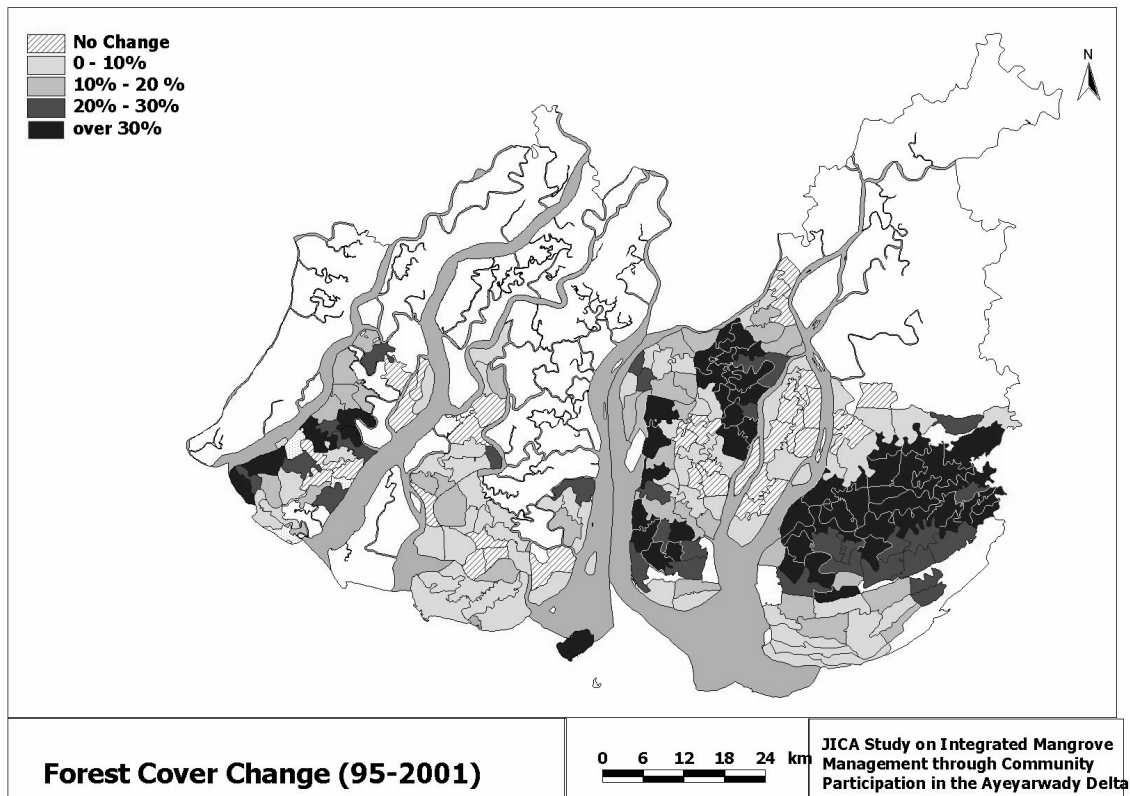


Figure 2.3 Forest Cover Change 1995 - 2001

2.2.3 Land Use and Vegetation of Each Reserved Forest

Based on results of 2002 aerial photograph interpretation and field survey, the general description of land use and vegetation of each reserved forest in the study area is summarized as follows. Figure 2.4 indicates forest compartment numbers and boundaries of each reserved forest in the study area.

(1) Kyakankwinpauk Reserved Forest

The summary of the Kyakankwinpauk Reserved Forest is described in the following table. The land use and forest type map of the reserved forest is indicated in Figure 2.2. This reserved forest is characterized with 1) extensive agricultural lands in the north to central which is continuous from an excluded area, 2) remaining mangrove forest in the southern central compartments, and 3) a mosaic of remaining mangrove forest and salt pan in southern coastline areas.

Summary of Land Use and Forest Type of Kyakankwinpauk Reserved Forest

1. Basic Information	
Location	Laputta Township, Myaung Mya District
Total Area:	25,222 ha
# of Compartments	39 forest compartments (numbers are sequential from the Kakayan Reserved Forest in the north)
Population:	28,702 (2002)
FD facilities:	3 FD camps, 1 nursery (Kwa Kwa Ka Lay)
2. Land Use	
Agriculture	Approximately 12,461 ha of paddy field (49.4 % of total reserved forest areas) exists. Continuous paddy fields are located in the northern to central compartments (1, 2, 3, 7, 9, 10, 11, 12, 13, 14, 15, 21, 22, 23, 24), the central western compartments (46, 47, 48, 49, 50, 52), the central western compartment (18), the southeastern compartment (33), and the southeastern compartment (17)
Salt Pan	Existing and operational in central to southern compartments of 17, 28, 29, 30, and 32. Approximately 594 ha in total. Potential expansions are observed by increase of dike/embankment construction.
Aquaculture	Existing and operational in central to southern compartments of 17, 29 and 32. Approximately 180 ha in total.
Village/Settlement	Approximately 45 villages scattered inside the reserved forest (based on 2004 Topographic map).
Mangrove	Approximately 7,865ha of mangrove forest (31.2% of total reserved forest areas) and 2,332 ha of area classified as woodlot/plantation exist. Concentrated in central to southern compartments. The central cluster of mangrove forests is recognized in compartments 18 (portion), 19, 20 24 (portion), 25, 26, and 27. The southern cluster is recognized in compartments 17 (portion), 28, 29, 30, 31, 32, and 34 (portion), 51, 54, 55, 56 57, 58, 60, 61, 62, 64, 65, and 66. In the north, mangrove forest remains to some extent in 1) boarder areas of compartments 7, 8, and 9, 2) compartments 4 and 5 of the U island.
Other land uses	Compartments that are a mosaic of mangrove and cultivation areas are 59, 63, 72, and 76. Weir and dike construction, possibly extension of existing saltpans and aquaculture ponds are recognized in southern compartments (2002).
3. Mangrove Forest Condition	
	The central cluster of mangrove forests are characterized with a combination of dense forest (crown density higher than 70%), sparse forest (crown density 40 -70%) and forest plantations, from which each forest can be distinctly identified. The southern cluster of mangrove forests are also similar but dense forests are more dominant and lacking forest plantations. The low-lying areas are dominated by <i>Rhizophora</i> species mixed with <i>Sonneratia</i> and <i>Avicennia</i> species. In medium ground level areas, <i>Heritiera fomes</i> , <i>Ceriops decandra</i> , <i>Bruguiera gymnorrhiza</i> , and <i>Excoecaria agallocha</i> are physiognomically dominant mangrove species. Species usually observed in the high levels are <i>Phoenix paludosa</i> and <i>Hibiscus tiliaceus</i> . However, non-mangrove species such as <i>Lagerstroemia</i> , <i>Syzygium</i> , and <i>Albizia</i> species are observed in northern compartments where water is of lower salinity due to heavy discharge of fresh water from upstream. In the southern coastal lines, high salinity tolerant species such as <i>Avicennia marina</i> , <i>A. alba</i> , and <i>Sonneratia alba</i> are prevalent and are sometimes observed growing in pure stands.
4. Remarks	Two clusters of excluded areas adjoin the reserved forest in the north (approximately 3,660ha) and in the south (approximately 1,860 ha).

Source: Based on Village Profile Survey (2002), 2002 Aerial Photo Interpretation, 2004 Topographic Map and Field Survey.

(2) Pyinalan Reserve Forest

A summary of the Pyinalan Reserved Forest is described in the following table. The land use and forest type map of the reserved forest is indicated in Figure 2.2. This reserved forest is characterized with extensive agricultural lands in the north, and the remaining mangrove forest in the south intermittently encroached by weirs and dikes.

Summary of Land Use and Forest Type of Pyinalan Reserved Forest

1. Basic Information	
Location	Laputta Township, Myaung Mya District
Total Area:	38,966 ha
# of Compartments	39 forest compartments (numbers are sequential from the Kakayan Reserved Forest in the north)
Population:	44,738 (2002)
FD facilities:	3 FD camps, 1 nursery (Thar Yar Kone), 1 seed production area (Ai Ma)
2. Land Use	
Agriculture	Approximately 12,176ha of paddy field (31.2 % of total reserved forest areas) and 3,366ha of uncultivated field exist. Continuous paddy fields are located in the northern compartments (38, 39, 40, 41, 42), the central western compartments (46, 47, 48, 49, 50, 52), the central eastern compartment (68), the southeastern compartment (67), and the southeastern compartment (75).
Salt Pan	Existing and operational in central to southern compartments 49, 52, 53, 59, 62, 65, 71 and 76. Approximately 918 ha in total. Potential expansions are observed by increase of dike/embankment construction.
Aquaculture	Existing and operational in central to southern compartments 45, 46, 48, 51, 60, 65, and 63. Approximately 281 ha in total. Potential expansions are observed by increase of dike/embankment construction.
Village/Settlement	Approximately 50 villages scattered inside the reserved forest (based on 2004 Topographic map).
Mangrove	Approximately 16,733ha of mangrove forest (42.9 % of total reserved forest areas) exists. Concentrated in southern compartments. One cluster of mangrove forests is recognized in the southeastern compartments 69, 70, 71, and 72. Another and vast cluster of mangrove forest is recognized in southern central compartments 51, 54, 55, 56, 57, 58, 60, 61, 62, 64, 65, and 66. However, villages/ settlements and other land uses are intermittently scattered inside the mangrove forest.
Other land uses	Compartments that are a mosaic of mangrove and cultivation areas are 59, 63, 72, and 76. Weir and dike construction are recognized at 60 sites, totaling 1,979 ha in southern compartments (2002).
3. Mangrove Forest Condition	
	The majority of mangrove forests are in a mosaic of dense forest (crown density higher than 70%) and sparse forest (crown density 40 -70%) with low to medium statures (not more than 12m). <i>Rhizophora species</i> are physiognomically a dominant mangrove species, particularly in the low ground levels. <i>Ceriops decandra</i> , <i>Excoecaria agallocha</i> , and <i>Heritiera fomes</i> are physiognomically a dominant mangrove species, particularly in the medium ground levels. High ground levels are physiognomically dominated by <i>Phoenix paludosa</i> , and <i>Hibiscus tiliaceus</i> . <i>Lumnitzera racemosa</i> are often observed in the sandy soil areas. In the southern coastal lines, high salinity tolerant species such as <i>Avicennia marina</i> , <i>A. alba</i> , and <i>Sonneratia alba</i> are prevalent.
4. Remarks	Countermeasures against illegal weirs/ dikes are imposed by FD but still such construction is on-going.

Source: Based on Village Profile Survey (2002), 2002 Aerial Photo Interpretation, 2004 Topographic Map and Field Survey.

(3) Kadonkani Reserve Forest

A summary of the Kadonkani Reserved Forest is described in the following table. The land use and forest type map of the reserved forest is indicated in Figure 2.2. This reserved forest is characterized with the Kadonkani Integrated Resource Management (IRM) areas in the center and paddy fields surrounding outskirts of the IRM areas and remaining areas of the reserved forest.

Summary of Land Use and Forest Type of Kadonkani Reserved Forest

1. Basic Information	
Location	Bogalay Township, Pyar Pon District
Total Area:	55,046 ha
# of Compartments	76 forest compartments
Population:	61,272 (2002)
FD facilities:	13 FD camps, 1 nursery and mangrove garden (Byone Hmwe island)
2. Land Use	
Agriculture	Approximately 31,971ha of paddy field (58.1 % of total reserved forest areas) exists. Compartments dominated with cultivation are # 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 41, 65, 66, 68, 69, 70, 71, 72, 73, and 74. Mostly concentrated in either northern or southern parts of reserved forest.
Salt Pan	Not identified
Aquaculture	Large-scale operational aquaculture was not identified.
Village/Settlement	Approximately 98 villages scattered inside the reserved forest (based on topographic map 2004).
Mangrove	Approximately 21,220ha of mangrove forest (35 % of total reserved forest areas) exists. Concentrated in the central IRM areas (compartments 36, 37, 38, 39, 40 (portion), 43, 44, 45, 46, 48 (portion), 50 (portion), 55, 56, 57 (portion), 58 (portion), 59, 60, 61 (portion), 62 (portion), 63 (portion), and 64 (portion). Other compartments such as #49 (Byone Hmwe island) and northern compartment 14 and southern compartment 76 are dominated with mangrove forest.
Other land uses	Compartments that are a mosaic of mangrove and clustered cultivation areas are # 47 and 67.
3. Mangrove Forest Condition	
	Nearly all of the mangrove forests in the IRM areas are classified as dense forest with crown density higher than 70%. However the majority of the forests are low to medium stature (not more than 12m) and in a recovering stage. <i>Heritiera fomes</i> is physiognomically a dominant mangrove species, particularly in the medium ground levels. Along the low-lying riverbanks and stream banks, <i>Avicennia</i> , <i>Sonneratia</i> and <i>Rhizophora</i> species dominate. In elevated or higher land areas of the riverbanks, <i>Phoenix paludosa</i> , <i>Hibiscus tiliaceus</i> , and <i>Brownlowia tersa</i> are physiognomically dominant mixed species.
4. Remarks	An excluded area exists in the inland of the southern part (approximately 1,010 ha).

Source: Based on Village Profile Survey (2002), 2002 Aerial Photo Interpretation, 2004 Topographic Map and Field Survey.

The IRM area was not declared as a protected area until 1997. Most of the high ground land had been converted into paddy fields and forest plantations have been established by FD in such open land areas. The Kadonkani IRM area has a species distribution and species pattern similar to the Meinmahla Reserved Forest. However, its vertical growth structure is relatively lower than that of Meinmahla Reserved Forest due to a time lag in strict protection for mangrove forests.

(4) Meinmahla Reserve Forest

A summary of the Meinmahla Reserved Forest is described in the following table. The land use and forest type map of the reserved forest is indicated in Figure 2.2. This reserved forest is protected primarily as a sanctuary for wildlife and for biodiversity conservation, and limited to forest land uses with no villages and settlements.

Summary of Land Use and Forest Type of Meinmahla Reserved Forest

1. Basic Information	
Location	Bogalay Township, Pyar Pon District
Total Area:	13,224ha
# of Compartments	15 forest compartments
Population:	n.a. (the FD camp staff reside inside the reserved forest)
FD facilities:	7 FD camps, 2 crocodile nurseries
2. Land Use	
Agriculture	Basically, protected for conservation, and production activities have been prohibited since 1990. Not existing. Formerly there were paddy fields.
Salt Pan	Not existing.
Aquaculture	Not existing.
Village/Settlement	Not existing, except for the FD camps.
Mangrove	The entire reserved forest is nearly covered by mangrove forest.
Other land uses	There are small portions of open land, which are remnants of old paddy fields.
3. Mangrove Forest Condition	
	Nearly all of the mangrove forests are classified as dense forest with crown density higher than 70%. High stature stands (height above 12 m) are prominent in inland compartments (# 3, 5, 8, 9) and southern compartments (# 11, 13, 14, 15) of the reserved forest. <i>Heritiera fomes</i> is physiognomically a dominant mangrove species, particularly in the medium ground levels. Along the low-lying riverbanks and stream banks, <i>Avicennia Sonneratia</i> and <i>Rhizophora</i> species dominate. In elevated or higher land areas of the riverbanks, <i>Phoenix paludosa</i> , <i>Hibiscus tiliaceus</i> , and <i>Brownlowia tersa</i> are the physiognomically dominant mixed species. Existing <i>Avicennia</i> and <i>Sonneratia</i> species are mostly in timber size.
4. Remarks	Some fishermen temporarily stay on the rivers and creeks inside the reserved forest. Illegal cutting for fuelwood and posts/poles is ongoing by surrounding villagers.

Source: Based on Village Profile Survey (2002), 2002 Aerial Photo Interpretation, 2004 Topographic Map and Field Survey.

Before it was designated as a protected area in 1990, the Meinmahla Reserved Forest was subjected to cutting for poles and piles, charcoal production, fuelwood collection, and conversion into paddy fields. In the early 1990s, this reserved forest was dominated by small size trees, and open land areas from former paddy fields were scattered. Stricter protection measures were imposed after declaration as a wildlife sanctuary in 1994, and the Meinmahla Reserved Forest is currently vegetated by pole-size to timber size mangrove trees. Apparently, this reserved forest has been protected effectively.

(5) Pyindaye Reserve Forest

A summary of the Pyindaye Reserved Forest is described in the following table. The land use and forest type map of the reserved forest is indicated in Figure 2.2. This reserved forest is characterized with large-scale paddy field development in the northern part of the reserved forest, and mangrove forest somewhat concentrated in the southern part.

Summary of Land Use and Forest Type of Pyindaye Reserved Forest

1. Basic Information	
Location	Bogalay Township, Pyar Pon District
Total Area:	73,669 ha
# of Compartments	66 forest compartments
Population:	60,945 (2002)
FD facilities:	5 FD camps
2. Land Use	
Agriculture	Approximately 35,225ha of paddy field (47.8 % of total reserved forest areas) exists. Areas classified as uncultivated (2,062 ha) and open land (2,869 ha) are also considered to be cultivated. Compartments dominated with cultivation are # 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 22, 23, 33, 34, and 40 in the northern half of reserved forest and # 57 in the southern half.
Salt Pan	Existing in the southern compartments (# 58, 59, 60). Approximately 418 ha in total. Potential expansions are observed by increase of dike/embankment construction.
Aquaculture	Large-scale operational aquaculture was not identified. Some of the embankment/dike construction is considered to be aimed for aquaculture.
Village/Settlement	Approximately 28 villages scattered inside the reserved forest (based on topographic map 2004).
Mangrove	Approximately 31,419ha of mangrove forest (42.6 % of total reserved forest areas) exists. Concentrated in central to southern compartments. Compartments dominated with mangroves are # 25, 26, 27, 28, 30, 31, 36, 37, 39, 43, 44, 46, 47, 48, 49, 50, 53, 54, 55, 56, 58, 59, 60, 61, 62, 63, 64, 65, and 66. In the northern part, there are clusters of sparse mangroves existing in forest compartments 14 and 15.
Other land uses	Compartments that are a mosaic of mangrove and clustered cultivation areas are # 15, 29, 35, 38, 41, 42, 45, 51, and 52. Weir, embankment, dike construction are recognized at 163 sites, totaling 2,292 ha (2002).
3. Mangrove Forest Condition	
	In the southernmost compartments (58-66), mangrove forests are somewhat continuous and classified as dense forest with crown density higher than 70%. Other dense forests are located in 1) central compartments of 36, 37, 39, 2) northern compartment #14 and 3) an island compartment #7. The remaining mangrove forests in the reserved forest are classified as sparse forest with crown density between 40 -70 %. <i>Nipa fruticans</i> is physiognomically a dominant mangrove species, particularly in the low ground levels. <i>N. fruticans</i> tend to establish homogenous stands but also mixed with <i>Brownlowia tersa</i> , <i>Kandelia candle</i> , <i>Avicennia species</i> and <i>Sonneratia species</i> . The high ground area, which is seldom reached by brackish water during high tide, is dominated by <i>Phoenix paludosa</i> and <i>Hibiscus tiliaceus</i> . In the southern coastal lines, high salinity tolerant species such as <i>Avicennia marina</i> , <i>A. alba</i> are prevalent.
4. Remarks	Some irrigation channels have been constructed for paddy development in the northern part of the reserved forest. An excluded area exists in the inland of the northern part (approximately 1,230 ha).

Source: Based on Village Profile Survey (2002), 2002 Aerial Photo Interpretation, 2004 Topographic Map and Field Survey.

(6) Illegal Weirs

The present study revealed that illegal embankment and dike constructions, mainly for aquaculture and salt pans, are predominant in Pyinalan and Pyindaye Reserved Forests. The GIS section, Planning and Statistics Department, FD, and the study team identified those embankments and dikes recognizable in aerial photographs of the study area taken in 2002. Especially, the aerial photograph interpretation result revealed that in the Pyinalan Reserved Forest and the Pyindaye Reserved Forest, mangrove forests of approximately 5% and 3% of the total reserved forest area respectively, had been enclosed by embankments and/or dikes. The following table indicates the condition of illegal weirs based on the aerial

photo interpretation results. Figure 2.5 shows the location of illegal weirs in the Pyinalan Reserved Forest and the Pyindaye Reserved Forest respectively.

Illegal Weir Condition in Pyinalan and Pyindaye Reserved Forests

Pyinalan Reserved Forest		Pyindaye Reserved Forest	
Area (ha)	# of sites	Area (ha)	# of sites
1,979	60	2,292	163

Source: 2002 Aerial Photo Interpretation

Most dike constructions (shrimp and prawn culture) were still in stages of either clearing the perimeter boundary or excavation of the ground inside the perimeter to make an embankment around the area, and actual production was seldom identified. Most of the area still had mangrove forest intact although it is already enclosed either partially or completely. Because some areas are cleared first before construction of dikes or embankments it was difficult to ascertain the purpose of clearing or intended uses of land without checking on the ground.

The divisional FD office has dispatched several investigation teams between 2003 and 2004 to check the condition of such illegal weirs, especially in the Pyinalan Reserved Forest. The investigation team reported that there were about additional 100 sites and owners of embankments all throughout the Pyinalan Reserved Forest. Owners of the weirs can be divided into either big investors from outside, such as Yangon, or small scale owners from surrounding villages. FD has taken legal measures against the illegal weirs, and some have been destroyed and converted to the FD's direct plantation sites. However, based on information collected by the study team, it is more likely that the majority of weirs are still intact or reconstructed. Moreover, new construction of weirs and aquaculture ponds seemed to be on going in the area. Details are not known, but based on results of aerial photo interpretation and the FD investigation team, the estimated annual rate of weir construction is approximately 1,100ha in the Pyinalan Reserved Forest.

In the Pyindaye Reserved Forest, illegal weirs are scattered throughout the reserved forest. Of such, weirs constructed in the southern coastlines are considered to be extensions of salt pans whereas, the remaining weirs in the central and the northern parts are aimed at fish/shrimp cultivation.

In the remaining reserved forests, illegal weirs were not identified by the aerial photo interpretation. However, it is considered that some illegal weirs exist, but details are not known for the remaining three reserved forests.

2.3 National Socioeconomic Condition

2.3.1 National Administration System and Development Policy

(1) Central Administrative System

The Cabinet and the State Peace and Development Council (SPDC) are responsible for overall decision making in the country. SPDC is chaired by the Senior General Than Shwe, and the council comprises a vice chairman, first secretary and second secretary. The

Cabinet is responsible for implementing overall national policies, and comprises 1) Prime Minister, 2) members of SPDC, 3) Ministers, 4) Ministers at the Prime Ministers' Office, 5) the Governor of the Central Bank of Myanmar, 6) Ambassador to the United States, and 7) the Permanent Representative to UN Headquarters. There are 33 ministries shown in Table 2.14 (Dec., 2004), after upgrading the Myanmar Information Committee to a Ministry.

(2) Regional Administrative System

The regional administrative system in Myanmar comprises four levels of administration: (a) division/state, (b) district, (c) township, and (d) village tract. Divisions are located in the area where the Burmese originally lived, whereas states are located at the peripheries of the country. Divisions/states comprise several districts, and districts comprise several townships. Village tracts are complexes of several villages. Each division/state, district, township and village tract has a Peace and Development Council (PDC). In this context, the village tract is the lowest level of national administration. However, a Village Tract Development Committee (VPDC) appoints 100-household heads and 10-household heads at village level, in proportion to the population of the village, though the candidates for the 100-household heads and 10-household heads are elected by vote of the villagers.

(3) National Socioeconomic Plan

The national development policy is broadly divided into two categories: economic development plan and social development plan. The national economic plan targets: (a) to develop agriculture as a base for economic growth and other sectors of the economy; (b) to maintain the market-oriented economic system; (c) to enhance economic development through promoting domestic and foreign investments; and (d) to shape the national economy for the government and national people.

The social development plan, on the other hand, focuses on 1) uplifting of the national morale and morality; 2) uplifting of the national prestige and integrity, and preservation and safe-guarding of cultural heritages and national characters; 3) uplifting of the dynamism of patriotic spirits; and 4) uplifting of the health and educational standards of the entire nation.

The specific national policies influential to forest, forestry, and mangrove areas directly or indirectly are described in Section 3.1.1.

2.3.2 Macro-economic situation

(1) GDP and Summary of Economic Situation

GDP in Myanmar in 2000/01 accounts was 1.2 billion kyat. The growth rate of GDP is estimated at 1.3 percent per annum. The GDP composition indicates that the agricultural sector is the leading sector in the country, contributing 48.8 percent of the GDP. The trade balance is in a situation of excess of imports. The excess of imports triggers a de-valuation of Myanmar Kyat in real terms, and inflation continues. Fiscal balance is on a deficit, amounting to 1.7 percent of the GDP in 2000. Historical data during 10 years suggests that the government is suffering from a chronic deficit, mainly due to the poor revenue

collection. This fiscal deficit is financed by borrowing from the central bank, by issuing a bill of treasury and bond, or by the arrears of the foreign external debt. Table 2.15 summarizes the macro-economic indicators in Myanmar.

(2) Trade

Trade balance is in a situation of excess of import. Commodities like agricultural inputs, machinery and manufacturing products are imported with the foreign currencies earned by exporting natural resources like (a) agricultural products, (b) timber, (c) rice. The trade structure clearly shows that the Myanmar economy is highly dependent on natural resources.

Terms of trade deteriorate by this excess of imports, which triggers the de-valuation of the Myanmar Kyat in real terms, illustrated by the higher exchange rate with US dollars. The Myanmar economy suffers from the continuous inflation, and a stagnant inflation.

It must be noted that the commodity structure has changed drastically from 1980 and 2000. In 1980, rice and teak were the major exports in Myanmar, representing 54 percent of the total export value, while in 2000 they account for only 1.6 percent of the total export value.

This is partly due to the limited availability of new paddy land, stagnant in its yield. Other products like fisheries increased their share of export, from 2.5 percent to 7.6 percent.

Composition of Export Products in Myanmar

(Unit: million kyat)

Item	1980/81		2000/01	
1. Agricultural Products	1,761	54.6%	2,312	18.8%
Rice and rice products	1,355	41.9%	208	1.6%
Pulse	152	4.7%	1,658	13.5%
Others	256	7.9%	476	3.8%
2. Animal Products	13		37	
3. Marine Products	82	2.5%	934	7.6%
Fish	58	1.7%	291	2.3%
Prawn	24	0.7%	598	4.8%
Others	-		45	
4. Timber	793	24.5%	803	6.5%
Teak	721	22.3%	651	5.3%
Hardwood	139	4.3%	152	1.2%
5. Base Metals	190	5.8%	324	2.6%
6. Precious metal	105	3.2%	363	2.9%
7. Gas	-	-	1,110	9.0%
8. Garments	-	-	3,785	30.8%
Total Export	3,225	100.0%	12,262	100.0%

Source: Central Statistical Organization, statistical yearbook 2001

(3) Inflation

Inflation has been high in recent years, largely because of increasing food prices, the continued magnetization of large public sector deficits, and excess liquidity caused by

financing government deficits through central bank credit. In 2000/01, inflation, which had averaged over 25% a year for more than a decade, dropped sharply by 4.0% from 15.6% in 1999/00 as shown below.

Consumer Price Index

(Unit: %)

Area	Item	1997/98	1998/99	1999/00	2000/01
Yangon	All items	33.9	49.1	11.4	n.a.
	Food and beverages	33.6	50.3	12.3	n.a.
	Non-food				
	Fuel and light	20.0	25.7	6.1	n.a.
	Clothing and apparel	34.5	62.2	7.2	n.a.
	House, rent and repairs	34.5	34.8	7.0	n.a.
Country	All items	2.6	30.1	15.6	-4.0
	Food and beverages	2.6	30.0	15.6	-8.2
	Non-food				
	Fuel and light	2.5	25.6	13.6	12.4
	Clothing and apparel	2.5	27.1	4.5	4.7
	House, rent and repairs	1.4	15.5	12.6	2.9

Source: Central Statistical Organization

This dramatic reversal in trend caused by a decline in food prices, particularly for rice, resulting from a good domestic harvest and low world rice prices. Another factor was the opening of tax-free markets in key urban centers, an effort to curb price increases.

(4) National Budget

Myanmar suffered from chronic national budget deficits due to poor tax compliance and a large informal economy. Government tax revenue is very low at 112 billion kyats, a 6.9% decrease over the previous year as shown below. Unable to significantly boost revenue collections, the government has sought to control the deficit by compressing capital expenditure, i.e. by slashing spending on investment projects.

National Budget

(Unit: million kyats)

Item	1995/96	1996/97	1997/98	1998/99	1999/00*
Revenue and grants	40,066	55,019	89,512	119,874	111,615
revenue collections	22,644	31,357	49,429	56,653	49,920
Non- revenue collections **	16,677	23,241	38,472	62,650	61,217
Foreign grants	745	421	1,611	571	478
Expenditure	59,260	72,518	87,932	104,187	112,494
Capital expenditure	31,821	42,919	50,365	60,919	60,396
Current expenditure	27,439	29,599	37,567	43,268	52,098
Balance	-19,194	-17,499	-1,580	15,687	-879

notes: 1) * provisional.

2) ** includes contributions from state economic enterprises.

Source: Central Statistical Organization

The budget deficit accounted for 1% of GDP in 1999/00, down from over 6% in the mid 1990s. Defense spending remains a high priority for the government, while spending on agricultural and forest have dwindled. Budget allocation to agriculture and forest,

education and health were 8.4%, 4.6% and 1.7% of the capital expenditure in 1999/00, respectively. In the absence of significant foreign lending, the government has financed the budget deficit through bank borrowing (Central Bank of Myanmar), the issuance of treasury bills and bonds, and the accrual of arrears on external debt.

(5) Exchange Rate

The government maintains a dual exchange rate system, which comprises the official exchange rate at 5.8 kyat per US\$ and so called authorized rate at 450 kyat/US\$ in August 2004 as shown below. Consequently, the official rate has become increasingly overvalued in real effective terms, and has been adopted to protect domestic industries.

Item	1995/96	1996/97	1997/98	1998/99	1999/00	2002/03	2004
Average official rate (kyat/US\$)	5.62	5.91	6.22	6.25	6.24	6.5	5.8
Average authorized rate (kyat/US\$)	114	147	209	318	344	450	450

Source: Central Statistical Organization (up to 2002/03), Myanmar foreign Trade Bank (for August 2004)

2.3.3 Agricultural Production

(4) Paddy

The marketing of paddy/rice was entirely controlled by the government during the centrally planned economic system (1962-1987). In 1988, the free market economic system was introduced by the government, gradually reducing its direct involvement in paddy/rice marketing. The private sector started to participate in the domestic marketing of paddy/rice, while export was in the hands of the government. The government of Myanmar changed its policy: in April 2003, abolition of the paddy procurement system and liberalization of the rice trade was announced. Since then, all nationals excluding government organizations have the right to do rice trading. The rice price is according to the prevailing demand, and monopoly on rice trading is not allowed to any one or any organization. The paddy sale principle was that:

- All nationals can trade rice freely in the domestic market.
- Export of rice can be carried out under the guidance of the Myanmar Rice Trading Leading Committee.
- Rice will be exported only when there is surplus.
- After 10% in export tax from export earnings is paid, the rest will be shared between the government and rice exporters at 50% each.

The Rice Trading Association resells to Myanmar Agricultural Produce Trading (MAPT), the organization that managed the purchase of paddy from farmers till April 2003, at the same price that they have purchased it.

2.4 Socioeconomic Condition of Ayeyawady Division

The Ayeyawady Division is one of the 14 divisions/states in Myanmar, and comprises 5 districts and 26 townships.

2.4.1 Population

Population in Ayeyawady Division is reported to be 7,952 thousand, as of October 2001, which accounts for 13.8% of the total population of Myanmar. The growth rate of the population in the five years 1996 - 2001 was 11 percent. The population density in the Division is estimated to be 2.0 persons/ha. This population density is a relatively small figure, compared to the national average of 14 persons per hectare. This situation suggests that there is still land for living in the area, which triggers an influx of people to the Division.

Population in Ayeyawady Division

Indicators	Unit	Ayeyawady Division	Union Total
Population in 2001	thousand	7,052	51,138
Population in 1995	thousand	6,216	44,744
Growth Rate 1995-2001	percent	102	104
Population Density in 2001	persons/hectare	2.0	14.6

Source: Central Statistic Organization, "Statistical Year Book 2001".

2.4.2 Products

(1) Forest Products

There are several forest products in the area. Detail of forest products is described in section 4.1.3 of this report. In this section, following dominant products in the study area are covered.

a) Fuelwood and Charcoal

During the period 1980/81 to 1989/90, 89,787 cubic tons of fuelwood and 320,874 cubic tons of charcoal (accounting for 0.6% and 14.4% of the national annual consumption, respectively) were produced annually from the study area. There is no denying fact that the forest areas in Laputta and Bogalay Townships have been substantially degraded, mainly due to over-exploitation for fuelwood and charcoal production. Since the ban on commercial production of charcoal in 1994, there has been no export of fuelwood and charcoal recorded from the reserved forests. Due to scarcity, the fuelwood price has increased exorbitantly. The rural population normally uses shrubs, brushwood, coconut leaves and agricultural residues while woody stems of climbers, shrubs and trees are used by the urban population in townships. Charcoal sold in the market is imported from non-mangrove areas. The production of fuelwood and charcoal in the whole country is shown in Table 2.16.

b) Nipa thatching

Nipa thatching is most commonly used for roofing materials, especially in rural areas. Nipa yield is estimated to be 6,700 thatches per ha and the labor cost for 100 thatches is 40 kyat. One nipa laborer can produce 250 thatches per day at the maximum.

(2) Agricultural Products

Major agricultural products in Ayeyawady Division are rice and the rice production holds a share of approximately 34 percent of the production of the country. The amount and share of rice production of each state and division is shown in Table 2.17.

It must be noted that the recent trends in the cultivated areas, production, and yields show that yields are in a stagnant situation, while production increases. The decrease of the yield is compensated by the increase of the net area sown. Considering the increase of the population, the situation implies that there is a potential pressure on the land and over-exploitation of natural resources, such as land productivity and fishery resources.

Changes in Cultivated Area, Production and Yield

Indicators	unit	Ayeyawady Division		Union Total	
		Amounts	Growth Rate	Amounts	Growth Rate
Net Area Sown in 1985	Acre	2,020,136	2.46	6,363,851	2.46
Net Area Sown in 1999/00		4,987,977		15,713,214	
Yield Per harvested acres in 1985	Lbs	3,157	0.97	2,764	1.04
Yield Per harvested acres in 2000		3,075		2,891	
Production in 1985	1000 ton	4,286.4	1.58	14,030	1.48
Production in 1999/00		6,783.9		19,807	
Population in 1985	Thousand	5,226	1.32	37,033	1.35
Population in 2000		6,921		50,125	

Source: Myanmar Agricultural Statistics (1989-90 to 1999-2000)

In the study area, monsoon paddy is the main agricultural product and its field occupies 13,049.6ha, that is, more than 90% of all cultivated area. Especially in the Kadonkani Reserved Forest, 96% of the cultivated land is monsoon paddy field. The average yield of paddy is 2,036 kg/ha in total, the highest in the Kyakankwinpauk Reserved Forest with the figure of 2,276 kg/ha and the lowest in the Pyindaye Reserved Forest with the figure of 1,672 kg/ha. By using this figure, the total production is estimated as around 26,600 tons in the study area.

Cropped Area, Yield and Production of Major Agricultural Products

Product Reserved Forest	Monsoon Paddy			Coconut Palm			Nipa		
	Cropped Area (ha)	Yield (ton/ha)	Production (ton)	Cropped Area (ha)	Yield (No./ha)	Production (No.)	Cropped Area (ha)	Yield (thatch /ha)	Production (thatch)
Laputta Township									
Kyakankwinpauk	4,804	2276	10,935	44.8	5,363	240,262	52.8	9,063	478,526
Pyinalan	2,994	2056	6,156	64.4	4,259	274,280	114.8	8,845	1,015,406
Sub-total	7,799		17,091	109		514,542	168		1,493,932
Bogalay Township:									
Kadonkani	1,979	2142	4,239	18.4	3,327	61,217	8	4,375	35,000
Pyindaye	3,272	1672	5,470	334.4	4,013	1,341,947	150	8,962	1,344,300
Sub-total	5,251		9,710	353		1,403,164	158		1,379,300
Total	13,050		26,801	462		1,917,706	326		2,873,232

Note: There is no cultivation land in the Meinmahla Reserved Forest.

Source: Village profile site survey, 2002, Central Statistic Organization, "Statistical Year Book 2002".

(3) Fishery Products

Major marine products in Ayeyawady Division are fish and prawn. Ayeyawady Division holds a share of approximately 34 percent of the production of the country, mainly composed of prawns. The fishery production of each state and division in Myanmar is shown in Table 2.18.

Fishery products shipped to Yangon for the years 2000/01 and 2001/02 are shown below.

Fishery Products Shipped to Yangon

Type of aquatic resource	Laputta Township (kg)		Bogalay Township (kg)		Total (kg)	
	2000/01	2000/01	2001/02	2001/02	2000/01	2001/02
Fish	115,147 (58.0)	563,382 (86.6)	589,854 (86.5)	176,857 (59.7)	678,529 (79.9)	766,711 (78.3)
Prawn/shrimp	29,233 (14.7)	53,309 (8.2)	55,989 (8.2)	46,464 (15.7)	82,542 (9.7)	102,453 (10.5)
Crab	54,104 (27.3)	34,161 (5.2)	36,422 (5.3)	73,082 (24.6)	88,265 (10.4)	109,504 (11.2)
Total	198,484 (100.0)	650,852 (100.0)	682,265 (100.0)	296,403 (100.0)	849,336 (100.0)	978,668 (100.0)

Note: Figures in parenthesis show proportions to the total as 100.

Source: Bogalay and Laputta Township Fishery Departments.

The marine harvest in Bogalay Township in 2001/02 was 682.3 tons of which 86.5% was fish, 8.2% was prawn/shrimp and 5.3% was crab. In contrast, the marine harvest in Laputta Township was only 43.4% of that for Bogalay, clearly underlining the more robust dealing in marine products within Bogalay Township. In the case of Laputta, fish accounted for 59.7% of the harvest, crab for 24.6% and prawn/shrimp for 15.7%. Of note is that the crab harvest in Laputta was double that of Bogalay indicating richer crab resources in the former township area. In the case of both townships, marine harvests indicate as high as an average 15.2% growth, causing risks related to indiscriminate and excessive fishing in the mangrove forests in the near future.

2.5 Socioeconomic Condition of the study area

2.5.1 Locations of the Villages

The villages are scattered around the five reserved forests in the study area. According to the results of the village tract survey, conducted in the study there are 359 villages in and adjacent to the five reserved forests. Figure 2.6 illustrates the locations of the villages. Most of the villages are located at the outskirts of the reserved forests. More than 60% of the villages in and adjacent to the reserved forest were established after 1949. Of the 100 villages out of 359 villages surveyed in the village profile survey, more than 60% of villages were with population less than 500.

According to 2004 topographical map, 221 villages are recorded inside the study area.



Figure 2.6 Location of Villages in the Study Area

Village Establishment Year

Unit: %

Township	1948 and before	1949 to 1988	1989 and after
Laputta	42.00	56.50	1.50
Bogalay	30.10	46.20	23.70
Average	36.05	51.35	12.60

Source: Village tract survey, 2002.

Distribution of Village Size by Population

Reserved Forest	<=250	250<= 500	500<= 750	750<= 1000	1000<= 1250	1250<= 1500	>1500	total	Average (person)	Median (person)
Kyakankwinpauk	19.8%	40.7%	14.0%	10.5%	5.8%	3.5%	5.8%	100.0%	594	431
Pyinalan	17.8%	31.1%	24.4%	4.4%	11.1%	0.0%	11.1%	100.0%	748	504
Kadonkani	17.6%	57.1%	17.6%	4.2%	0.0%	0.8%	2.5%	100.0%	515	408
Pyinalan	13.0%	40.0%	25.0%	11.0%	4.0%	1.0%	6.0%	100.0%	609	486
Total	16.9%	44.9%	19.7%	7.7%	4.0%	1.4%	5.4%	100.0%	591	430

Source: Village profile site survey, 2002

2.5.2 Demography

The total population in the study area in 2002 has been estimated at 206,939 (being about 0.4% of the national total).

Internal migration and mobility have been a common phenomenon in this country. A great number of inter- and intra-migrants have flocked to the reserved forest areas for temporary or permanent employment opportunities and settled within the forests. This is evidenced by the fact that the average annual rate of population growth for the period 1994 to 2002 in the study area averaged 3.33% (higher than the national average of 1.9 %).

Number of Households and Average Family Size

(Unit: No.)

Reserved Forest	Population	Number of villages	Average village population	1994 -2002 Growth Rate (%)	Population Projections			Number of households	Average Family Size
					2005	2010	2020		
Laputta Township:				1.90					
Kyakankwinpauk	39,984	86	465	3.41	44,200	52,300	73,100	8,021	5.0
Pyinalan	44,738	45	994	3.97	50,200	61,000	89,900	8,012	5.6
Sub-total	84,722	131	647	3.70	94,600	113,400	163,100	16,033	5.3
Bogalay Township:				1.79					
Kadonkani	61,272	119	515	4.20	69,400	85,200	128,700	11,392	5.4
Pyindaye	60,945	100	609	2.03	64,800	71,600	87,500	11,135	5.5
Sub-total	122,217	219	558	3.07	133,900	155,700	210,700	22,527	5.4
Total	206,939	350	591	3.33	228,300	269,000	373,400	38,560	5.4

Source: Village tract survey, 2002.

2.5.3 Ethnicity and Religion

Most of the people living in the study area are Burmese. However, there are several ethnic groups of Karen, Yakhine, and Indians. Villages of Karen people can be found in the Pyinalan Reserved Forest in Laputta Township, and in the Pyindaye Reserved Forest, Bogalay Township. With respect to the religion, nearly 90% of the population is Buddhist, while the rest are Christians, Muslims, Hindus, and others.

The ethnicity and religion have some relationship; the Karen have their own unique social structure, and in contrast to the Burmese which are Buddhist, the Karen are Christian (Baptist) and have churches within their hamlets. According to the village profile site

survey results, the principal ethnic groups are Burmese (73.0%), followed by Karen (22.6%), Yakhine (2.6%) and Indian (1.7%) in the rural areas of Laputta Township, while Burmese are 91.0% of the rural population, Karen at 8.5%, Yakhine at 0.3% and Indian at 0.2% in Bogalay Township.

According to the result of the rural rapid appraisal (RRA) conducted in the study, every village has religious groups whether it is Christian or Buddhist. It is one of the purposes of villager's living life to save money to construct or renovate a monastery or church or to donate to a monastery or church, and above all, these religious facilities are the place of villagers' cohesion. Also, relationship with the religious centers outside the village is strong, for example Pathein Church for Christian Karen, and it is one of the motives of communication and transportation of villagers with the outside.

Ethnic Groups in Reserved Forest

(Unit: %)

Township	Burmese	Karen	Yakhine	Indian	Others*
Laputta Township:	73.0	22.6	2.6	1.7	0.1
Bogalay Township:	91.0	8.5	0.3	0.2	0.0

Note: * includes Chinese and others.

Source: Village profile site survey, 2002.

2.5.4 Landholding

The study area is characterized by a predominantly mono-cultural agricultural economy and small land holdings. Though, the study area, as the reserved forest, legally belongs to FD, customary land ownerships and land use rights exist inside the reserved forest. The size of land held by a household varies from 2.0ha in the Pyindaye Reserved Forest to 9.5ha in the Kyakankwinpauk Reserved Forest. Disparities in income and employment opportunities are wide and persistent due to land holding size and availability of local resources. Apart from the disadvantaged segment of the rural population, food security is guaranteed through higher income groups who are practicing larger scale farming. Smaller land holding households indicate increasing difficulties in supporting the food requirements of their livelihood.

Land Holding Size and Land Tenure

Reserved Forest	Land holding Size			Land Tenure			Type of Farmers		
	<1.2 ha (%)	1.2-4.0 ha (%)	4.0ha < (%)	Ave (ha)	Inherited (%)	Purchased (%)	Reclaimed (%)	Owner (%)	Tenant (%)
Laputta Township:									
Kyakankwinpauk	2.3	16.4	81.3	9.5	44.6	13.1	42.3	97.7	2.3
Pyinalan	2.3	27.6	70.1	6.8	30.8	16.0	53.2	97.1	2.9
Sub-total	2.3	22.3	75.4	8.0	37.2	14.7	48.1	97.4	2.6
Bogalay Township:									
Kadonkani	12.1	42.2	45.7	4.1	7.9	43.9	48.2	97.9	2.1
Pyindaye	41.0	43.3	15.7	2.0	31.8	12.6	53.7	95.9	4.1
Sub-total	34.3	43.0	22.7	2.5	26.3	19.9	52.4	96.4	3.6
Total	25.1	37.1	37.8	4.1	29.4	18.4	51.2	96.7	3.3

Source: Village profile site survey, 2002

2.5.5 Occupational Structure (Income Level)

(1) Occupational Structure

The occupation in the village can be categorized: (a) agricultural people, (b) fishery people and (c) casual labour people.

Main Income Source and Income Source Concentration

Reserved Forest	Main income source (livelihood) % of households				Income source concentration ^{*1}			Average of land tenure (ha)
	Agriculture	Fishery	Casual Labour	Others	Agriculture	Fishery	Casual labour	
Kyakankwinpauk	39.9%	9.5%	45.7%	4.9%	7.0%	0.0%	54.7%	9.5
Pyinalan	22.0%	14.5%	57.2%	6.3%	13.3%	2.2%	55.6%	6.8
Kadonkani	35.4%	17.9%	37.6%	9.1%	39.5%	5.0%	24.4%	4.1
Pyindaye	41.7%	4.7%	48.2%	5.4%	56.0%	0.0%	35.0%	2.0
Average	33.6%	12.1%	47.9%	6.4%	32.9%	2.0%	33.4%	4.1

Note: ^{*1} Percentage of villages where 50% or more households are engaged in each income.

Source: Village tract survey, 2002.

(2) Agricultural People

The large farmers sell their surplus paddy to local collectors/millers and earn cash income required for household necessities. Similarly, the medium farmers also sell a limited quantity of food grains during the harvesting period of paddy to solve the household cash crisis and buy some needed items. However, there are many cases in which farmers sell all harvested paddy and procure food requirements (inferior quality of rice or broken rice) of their livelihood from the local markets.

Farmers domesticate buffalo, duck, chicken, and fish. Larger farmers earn more income from raising livestock and poultry than small farmers, while farmers specializing in aquaculture earn more than those engaged only in paddy cultivation irrespective of land holding size.

(3) Fishery People

There are two types of fishery people in the area: (a) full-time fishery households and (b) part-time fishery people. Full-time fishery people earned much more than the high income farm groups, while part-time fishery households (landless households) engaged in crab catching live on a subsistence basis.

(4) Casual Workers

Since the majority of small farmers and landless households suffer difficulties in maintaining their livelihood, they must work as agricultural laborers during the peak agricultural season at the average daily wage rate of 400-500 kyat. Thus, agricultural labor is particularly important for small households, which are able to earn more by providing agricultural labor than from actual crop production, a situation that applies to landless households as well.

2.5.6 Transportation Infrastructure

Major transportation infrastructures in Ayeyawady Division are roads and inland waterways.

(1) Road

Most of the roads in the division are simple earth roads and tracks that are not always passable by motorized vehicles, particularly during the rainy season. Even major roads with heavy traffic are narrow, unpaved and in poor condition. Roads connecting townships are generally poor and roads between village tracts and villages are much worse and often impassable after heavy rain. Typical village roads are only fit for transport by ox-cart. The Public Works Department under the Ministry of Construction collects road utilization charges on roads. State-owned trucks and commodities are exempted from the charges. All charges collected are used for the purpose of repairing and maintaining the roads.

(2) Inland Waterways

The country's extensive inland waterways remain the principle means of long-distance transport not only in the study area but also in the entire country.

In the study area, principal modes of transportation are by oared boat, bicycle or on foot. Village roads are unpaved and sometimes impassable during the rainy season. Public facilities such as roads, wooden bridges, and boat piers are maintained through the common labor of area villagers.

2.5.7 Communication

(1) Telecommunication Facilities

Telecommunications are non-existent at the village level, and even in Laputta and Bogalay. Townships telephone penetration rate is extremely low. Inadequate telecommunication infrastructure implies that the opportunities for information exchange and other necessary related services will remain severely constrained.

(2) Transmission of Government Instruction

The government instructions are transmitted to the local people by each stratum of the Peace and Development Council. Village authorities such as 100 household head and 10 household heads receive instructions from VPDC and call household heads to transmit them. Generally, villagers have regular meetings in the village for this purpose.

2.5.8 Water

Water is one of the critical issues in the study area, especially in the dry season.

There are several sources of water in the study area: (a) well, (b) pond, (c) river and stream, (d) water tanks and (e) buy from the sellers. In rainy seasons, people are obtaining water

from water tanks, used for tapping rainwater. Water from rivers and streams is sometimes used for domestic purposes, like bathing, laundry, cooking utensil washing, and so on. However, the water has high contents of silt, is a milkfish colour and is unsanitary, so it is not suitable for drinking. The use of unsanitary water is one of the causes of the high incidence of water borne disease such as diarrhea.

In dry seasons, people are obtaining water either from (a) well and pond or (b) buying from the sellers and merchant. Owners of wells sell water at a price of 5-8 kyat per four gallons at well side, earning up to 5,200 kyat per day. The water merchants are selling the water on a drum can basis. The price for the water amounts 30 to 50 kyat per five gallons including transportation cost, though it fluctuates depending on the distance from the original water sources the merchants buy from.

Sources of Water

(Unit: %)

Reserved Forest	Rainy Season					Dry Season				
	Dug Well	Pond	River/Creek	Water Tank	Others*	Dug Well	Pond	River/Creek	Water Tank	Others*
Laputta Township:										
Kyakankwinpauk	22.3	42.3	0.0	35.4	0.0	26.4	73.6	0.0	0.0	0.0
Pyinalan	4.4	21.2	0.0	71.2	3.2	46.3	22.8	0.0	0.0	30.9
Sub-total	12.4	30.6	0.0	55.2	1.8	37.3	45.6	0.0	0.0	17.1
Bogalay Township:										
Kadonkani	0.0	0.0	0.0	100.0	0.0	0.8	35.3	4.0	1.0	58.9
Pyindaye	14.5	11.3	0.7	68.3	5.2	25.8	17.4	0.7	2.4	53.7
Sub-total	7.7	6.1	0.4	83.0	2.8	14.1	25.8	2.2	1.8	56.1
Total	9.5	15.4	0.2	72.5	2.4	23.0	33.3	1.4	1.1	41.2

* Purchases from drinking water merchant.

Source: Village profile site survey, 2002.

2.5.9 Sanitation

The type of sanitation facility provides an index for assessing the economic status of respective households. Types of latrine include flush toilet, fly-proof latrines, open pit latrines, and other makeshift latrines. In some cases these may be located beside rivers and streams, or within the dwelling area itself. Latrines can be constructed from nipa leaves or woven bamboo.

Based on the results of the village profile survey, 32.1% of total households in the Laputta rural areas are equipped with flush toilets or fly-proof latrines (25.5% in the case of Bogalay rural areas). Households using unsanitary open pits or no latrine at all account for 65.0% of the total, being highest at 66.8% for the Kyakankwinpauk reserved forest and lowest at 62.7% for the Kadonkani reserved forest. Under the UNDP Human Development Initiative Extension (HDI-E) program, subsidies and latrine construction materials are provided with the aim of upgrading sanitary conditions in rural areas. Sanitary conditions in the study area are summarized below.

Sanitary Conditions

(Unit: %)

Reserved Forest	None	Flush Toilet	Fly-proof Latrine	Open Pit Latrine	Others*
Laputta Township:					
Kyakankwinpauk	37.8	0.0	30.5	29.0	2.7
Pyinalan	40.1	1.2	32.2	26.5	0.0
Sub-total	39.1	0.6	31.5	27.6	1.2
Bogalay Township:					
Kadonkani	30.6	0.2	29.5	32.1	7.6
Pyindaye	40.8	0.0	21.8	24.2	13.2
Sub-total	36.0	0.1	25.4	27.9	10.6
Total	37.2	0.3	27.7	27.8	7.0

Note: * includes septic tank and a latrine shared with other families.

Source: Village profile site survey, 2002

2.5.10 Education

In principle, attending primary school is free. Other educational facilities include monastic schools offering traditional education in both religious and secular subjects provided by Buddhist monasteries. In the case of the study area, budgetary constraints limit the various levels of government provided educational facilities to only the larger villages indicating a significant backwardness in educational infrastructure as shown below.

School buildings are constructed with contributions by local villagers or assistance from donors in the study area. With no assistance being provided by the government, local residents themselves are forced to address the serious problems of inadequate school equipment (desks, chairs, blackboards, etc.), teaching materials, and teaching staff. As of the year 2002, teacher pay runs around 65,000-80,000 Kyats/10 months (equivalent, if paid in kind, to 2,100 kg of paddy / 10 months), which although not an expensive salary still places an extreme burden on local villagers. Onerous school fees and supplemental costs prevent many families from enrolling their children in primary school.

Although primary school attendance is nominally free, parents incur significant expenses in sending their children to school, including expenditures on textbooks, uniforms, exercise books, stationery, a mandatory yearly contribution to the Parent Teacher Association fund, and ad hoc contributions in cash and in kind for school improvements. These expenses create obstacles to school enrollment among the poor.

Educational and Medical Facilities

Reserved Forest	Number of education facilities				Number of medical facilities			
	Monastic School	Primary School	Middle School	High School	RHC	Sub-RHC	Private Clinic	Others*
Kyakankwinpauk	14 (128)	15 (119)	1 (1,786)	0 (0)	0 (0)	4 (447)	1 (1,786)	0 (0)
Pyinalan	11 (200)	14 (157)	3 (733)	0 (0)	0 (0)	3 (733)	0 (0)	0 (0)
Kadonkani	15 (201)	17 (178)	4 (755)	2 (1,511)	2 (1,511)	1 (3,021)	1 (3,021)	0 (0)
Pyindaye	25 (139)	33 (105)	6 (578)	1 (3,465)	0 (0)	2 (1,733)	2 (1,733)	1 (3,465)
Total/Average	65 (161)	79 (133)	14 (748)	3 (3,490)	2 (5,235)	10 (1,047)	4 (2,618)	1 (10,470)

Note: Figures in parenthesis indicate the number of households per school or medical facility. RHC: rural health center

Source: Village profile site survey, 2002

2.5.11 Health and Medical Services

Rural health centers have been established in the rural areas of both Laputta and Bogalay Townships which offer health and medical related services (inoculations, antenatal education, advice on child-rearing, etc.). Under the jurisdiction of these rural health centers (RHC), sub-rural health centers (Sub-RHC) and station hospitals have also been established.

Community health workers are permanently assigned to the larger villages where they provide primary health care services. In the case of medium to small villages, however, there are neither medical related personnel nor pharmaceutical outlets. Ill persons are thus forced to travel by boat to the nearest village where a community health worker is on call. On the basis of medical examination there may be cases where medicine purchase at the village pharmacy suffices. In the event of serious illness, the patient may be forced to travel to the hospital located in the township capital. Doctors, health assistants, lady health visitors, and midwives are state employees assigned by the government. In the case of community health workers, although these receive government training, they are not accorded any compensation from the government and instead rely on medical examination fees paid by their patients.

According to UNDP data for Laputta rural areas, the crude death rate is 6.8 per 1,000 people (6.6 in the case of Bogalay); the infant mortality rate is 56.8 per 1,000 people live births (75.9 in the case of Bogalay), the under 5 years of age mortality rate is 98.7 per 1,000 people live births (103.5 in the case of Bogalay), and the maternal mortality rate is 19.2 per 1000 live births (4.7 in the case of Bogalay). In the case of both townships, the infant mortality rate greatly exceeds the national average of 49.8 per 1,000 people live births with that for Bogalay being conspicuously high. It is assumed that this is the result of a range of factors including not only a high incidence of pathogenic disease, but also malnutrition and a low rate of inoculation against normally preventable illnesses. The rural population has generally constrained access to basic health and medical services compared to urban population, a situation further aggravated by the fact that the high cost of medical fees places a severe financial burden on the impoverished segment of the rural population.

2.5.12 Housing

Building materials used for dwelling differ depending on the level of the household economy. The more wealthy villagers roof their dwellings with relatively expensive and durable corrugated iron sheets. Landless and marginal farmers comprising the most impoverished segment of the rural population resort to roofing of cheap and generally flimsy toddy-palm leaves, nipa leaves or grass thatching. Housing conditions in the study area are shown below.

Housing Conditions

(Unit: %)

Reserved Forest	Housing Structure					Roofing Materials		
	Wood/ Bamboo	Wood	Bamboo/ Nipa	Wood/ Nipa	Others*	CGI Sheet	Grass/ Nipa/Palm	Others**
Laputta Township:								
Kyakankwinpauk	1.3	2.9	47.7	48.1	0.0	0.6	99.4	0.0
Pyinalan	1.4	7.2	31.6	59.6	0.2	1.1	98.9	0.0
Sub-total	1.3	5.3	38.8	54.5	0.1	0.9	99.1	0.0
Bogalay Township:								
Kadonkani	8.5	8.9	45.8	35.3	1.5	4.6	95.4	0.0
Pyindaye	4.6	2.8	39.2	51.4	2.0	1.1	98.7	0.2
Sub-total	6.5	5.6	42.3	43.9	1.7	2.7	97.2	0.1
Total	4.5	5.5	41.0	47.9	1.1	2.0	97.9	0.1

Notes: * indicates bamboo or brick structure, while ** shows cement-plated roofs.

Source: Village profile site survey, 2002.

According to the village profile survey results, grass, nipa or palm roofed dwellings account for 99.1% of the households in the Laputta rural areas (being highest at 99.4 for the Kyakankwinpauk Reserved Forest) and 97.2% in the Bogalay rural areas (being highest at 98.7% for the Pyindaye Reserved Forest), underscoring the more impoverished status of the Laputta rural population.

2.6 Current Value of Mangrove Forest

2.6.1 Introduction

This section describes an estimate of the existing values of the mangrove forest. The inhabitants of the reserved forests rely on the natural resources from the mangrove forest for not only their livelihood, but also living environment. Therefore the Government of Myanmar recognizes the mangrove forest as a multifunctional one that can sustain peoples' lives, protect land, and supply natural resources. In respect of the functions, the value is estimated.

Conventional assessment of mangrove has focused entirely on the productive uses of mangroves, e.g., timber, poles, fuelwood, charcoal, aquaculture, and so on, while ignoring other important productive uses such as environmental functions and services provided by mangroves. The main reason for this is that the conventional cost-benefit analysis, which is widely used as a decision-making tool for public investment and policy making, fails to adequately capture the environmental benefits that are non-marketed goods and services, or cannot be adequately valued economically. As a result, projects and policies that do not truly have economic efficiency may be selected, leading to substantial economic losses. Accordingly, such important environmental functions and services have been computed in monetary terms with assumptions to value the socioeconomic value of the present mangrove forest in the study area.

2.6.2 Function of Mangrove Forest

Function of mangrove forest is categorized as use and non-use values. The use values are production from mangrove forest and the non-use values are effects by various forest functions such as biodiversity conservation, erosion and flood control, and carbon sequestration. The methods for evaluation of each role are shown in the following table.

Methods of Valuating Mangrove Forest by Function

Functional Role	Indicator for Evaluation	Valuation Technique
Use Values		
1) Fuelwood, charcoal, medicine, timber, construction materials, dyes, tools	1) Net sales values	1) Direct valuation
2) Fisheries	2) Net sales values	2) Direct valuation
3) Fodder for livestock	3) Net sales values	3) Direct valuation
4) Honey and wood vinegar	4) Net sales value	4) Direct valuation
5) Tourism and recreation	5) Travel cost and Net sales values /Willingness-to-pay	5) Travel cost method or contingent valuation method
Non-use Values		
1) Water purification	1) Depreciation cost and O&M cost for water purification facilities that have a purification capacity equivalent to the mangrove forests	1) Replacement cost method
2) Biodiversity conservation (fauna and flora)	2) O&M cost for conservation area that has equated to a conservation area having equivalent biodiversity based on the data including number of species inhabiting, endemic, and rare species	2) Replacement cost method
3) Coastal erosion protection	3) Depreciation cost and O&M cost for riverbank erosion prevention structure that has a preventive capacity equivalent to the mangrove forests	3) Preventive expenditure method
4) Flood/Cyclone protection	4) Depreciation cost and O&M cost for structures such as the dike that has a preventive capacity equivalent to the mangrove forests	4) Preventive expenditure method
5) Windbreak forest	5) Cost for planting, O&M of windbreak forest that has a wind protection capacity equivalent to the mangrove forests	5) Preventive expenditure method
6) Carbon Sequestration	6) Contracted trading price of CO ₂ under international trading mechanism	6) Contracted trading price

As shown in the table, the multifunctional roles of mangrove forests are able to be directly and indirectly converted into marketable goods and services to calculate the benefits in monetary terms with adoption of different valuation techniques. In this evaluation, however, the volume of socioeconomic value, which are limited due to quantitative difficulty in the valuation as well as non-availability of necessary data and information, can be broadly divided into two categories: 1) direct benefits comprising fuelwood production and fish/shellfish productivity, and 2) indirect benefits comprising biodiversity conservation (medicinal plant seeds use), coastal erosion and flood control, and carbon sequestration.

2.6.3 Valuation of Each Function

The value to be generated by the present mangrove forest is diverse, including external socioeconomic value (secondary value). In this evaluation, the use values (comprising fuelwood production and fish and shellfish productivity), and non-use values (comprising biodiversity conservation: use of medicinal plant seeds, coastal erosion and flood protection, and global warming prevention) have been computed as the socioeconomic value of the present mangrove forest in the study area.

The valuation methodology employed to estimate the values of the different characteristics of the mangrove forest in the study area is summarized below. Unit prices applied for the estimation are based on 2002 constant price in the Myanmar kyat, except for carbon sequestration which adopts the price from the Prototype Carbon Fund Report 2002 of the World Bank.

(1) Use Values

1) Fuelwood Production

The benefit for fuelwood production has been measured based on direct net revenues, i.e. the net value of one bundle of fuelwood has been estimated at 4.5 kyat by deducting the production cost (0.5 kyat) from its farm-gate price (5.0 kyat).

2) Fish and Shellfish Productivity

The value of fish and shellfish production was measured as direct net revenues, i.e. fishery net value has been computed based on the landing volume of fish, shrimps/prawns and crabs in Laputta and Bogalay Township fish markets and their farm-gate prices. It should be noted that the fishery net value is underestimated because the value of home consumption of fishery products and sales in small local markets was not included.

(2) Non-Use Values

1) Biodiversity Conservation (medicinal plant seed use)

Mangroves provide habitats essential to the life-cycle of various fauna and flora, including aquatic animals such as fish and shellfish that depend on mangrove areas for spawning and juvenile development. Many species of migratory birds depend on mangroves for resting or feeding while on migration. The methodology for valuation of biodiversity conservation here includes the use of commercial medicinal plants (seed of *acanthus* species) that is a part of vegetation supporting such life cycle. These medicinal plant seeds are used as raw materials for Chinese herbal medicine and effective treatment against septicemia. Collection of the seeds from natural mangrove forest is important and regular work for villagers during the dry season (December to March), when there is generally a scarcity of work.

2) Coastal Erosion and Flood Protection

Mangroves protect or reduce the erosion of coastlines and riverbanks, thus preventing the loss of valuable agricultural land and property through the binding and stabilization of soil by plant roots and deposited vegetative matter, the dissipation of erosion forces such as wave and river water flow energy, and the trapping of sediments. Since land is a traded commodity in the study area, the value of the erosion and flood control effects of mangroves may involve estimating the land area lost due to erosion and flooding, and valuing that loss at the current agricultural land price (54,340 kyat/ha). The value of land area lost as a result of shoreline and riverbank erosion and flooding is based on the paddy cropping area in the study area that would be damaged or lost in a 1 in 10 year flood.

3) Carbon Sequestration

Mangrove forests have an important role in regulating carbon dioxide in the global atmosphere through the processes of respiration and photosynthesis, whereby plants absorb carbon dioxide and store it in their biomass. Therefore, another major ecological function of mangroves is to serve as a carbon sink. In estimating a monetary value of the carbon sequestered by the forest, an international price per unit amount of carbon reduced has to be applied. For this evaluation, the price adopted was US\$ 3.50 per ton of carbon based on the 2002 contracted central prices for Prototype Carbon Fund transactions. The indirect value of mangroves for carbon sequestration (6.47 ton-carbon/ha) therefore amounted to US\$22.60/ha/year in 2002. The annual carbon sequestration has been calculated using the following equation: 6.47 ton-carbon/ha (carbon sequestration) = 1 ha (forest area) x 5.429 m³ (biomass growth) x 0.65 (relative density) x 0.5 (dry weight) x 44 (CO₂ density) / 12 (O₂ density).

2.6.4 Current Value of Mangrove Forest by Functions

The socioeconomic value of the present mangrove forest in the study area is summarized below. The valuation measures employed for each function are shown in the in Table 2.19 attached.

Current Value of Mangrove Forest in the Study Area

Functions and Services	Total Value (million kyat/year)	Value per ha (kyat/ha/year)
<u>Use Values</u>		
Fuelwood production	219.8	3,963
Fishery productivity	3,033.5	54,696
<u>Non-Use Values</u>		
Medicinal plant seed production	83.7	1,509
Erosion and flood control	222.5	4,012
Carbon sequestration	1,280.5	23,088
Total	4,840.0	87,269

The total socioeconomic value of the multiple roles of the present mangrove forest in the study area is estimated at 4,840 million kyat/year and 87,000 kyat/year/ha after dividing the

annual value by 55,461 ha , i.e. the current area of mangrove forest (closed mangrove forest on aerial photo 2002) in the study area.

2.6.5 Conclusion

The socioeconomic value is estimated at 4,840 million kyat per year. The value is equivalent to 230% of the annual income of FD, i.e., 2,083 million kyat, for the fiscal year 2003. Accordingly, the local population receives intangible valuable multifunctional benefit from existing mangrove forests, and in this regard it is essential to recognize anew the extreme socioeconomic importance of the mangrove forests in the study area.

As long as the present mangrove forest remains unchanged, the mangrove forest increases its annual value every year. Moreover, the implementation of the proposed IMMP will promote rehabilitation and afforestation of the degraded mangrove forest areas and thereby generate further multifunctional value and make possible optimal exploitation of the multiple functions of mangrove management by beneficiaries over the middle and long term under integrated mangrove management.

2.7 Socioeconomic Condition and Livelihood of Local People

2.7.1 Poverty

Based on the village profile site survey, the incidence of poverty in the study area has been estimated on the assumption of a poverty line calculated at 100,000 kyat/year in reference to the UNDP poverty line definition of 8,000 kyat/month per household.

Poverty Incidence (2002)

(Unit :%)

Reserved Forest	Poverty Incidence
Laputta Township:	
Kyakankwinpauk	33.0
Pyinalan	35.3
Sub-total	34.3
Bogalay Township:	
Kadonkani	59.6
Pyindaye	54.5
Sub-total	56.9
Total	48.3

Note: The poverty line is 100,000 kyats/year per household.

Source: Village profile site survey, 2002.

The overall poverty conditions by different reserved forest have been evaluated based on the following six criteria: (i) occupation (% of casual labor households), (ii) land ownership (% of landless households and farm households with less than three acres), (iii) housing condition (% of households with grass/nipa/palm thatch roofs), (iv) toilet use (% of households using open pit latrines or no latrine), (v) education (% of population with monastic or primary school education or no education), and (vi) income (% of households with annual incomes of less than 100,000 Kyat) as shown in the table below.

Overall Poverty Conditions

(Unit: %)

Reserved Forest	Occupation	Land Ownership	Roofing Material	Toilet Use	Education	Annual Income
	Casual Labour	Landless/ Farm HHs*	Grass/Nipa /Palm	Open Pit/None	Primary/ None	<100,000 Kyat
Laputta Township:						
Kyakankwinpauk	59.6	60.1	99.4	66.8	92.7	33.0
Pyinalan	63.1	63.6	98.9	66.7	94.9	35.3
Sub-total	61.6	62.0	99.1	66.7	94.0	34.3
Bogalay Township:						
Kadonkani	63.2	65.1	95.4	62.6	82.4	59.6
Pyindaye	37.7	56.7	98.7	64.9	40.4	54.5
Sub-total	49.6	60.6	97.2	63.9	60.3	56.9
Total	54.2	61.1	97.9	64.9	72.1	48.3

Note: * shows farm households with less than 3 acres.

Source: Village profile site survey, 2002.

As a result of the overall evaluation of poverty conditions for each reserved forest, the Pyinalan Reserved Forest has been ranked to be the poorest area, followed by the Kyakankwinpauk, Kadonkani, and Pyindaye Reserved Forests.

In order to rectify these skewed levels in poverty conditions, it is necessary to pursue crop diversification suitable for the local environment with specific focus on a shift from mono-cultural to diversified agriculture, a transition from traditional cropping patterns to the introduction of high value crops (from food crops only to diversified agricultural activities including horticultural cropping, animal husbandry and fish farming), expansion of production in the agricultural product processing sector, as well as an increase in non-agricultural production activities based in rural areas (the nurturing of regional cottage industries).

2.7.2 Markets and Prices

(1) Markets of Forest Products

Though a ban for commercial charcoal production in the reserved forest of Ayeyawady Division was issued in 1994, the Ayeyawady Division (particularly the delta region and the west coast) is still one of the principal sources of fuelwood for Yangon, the largest consuming area. In the study area, woodfuel marketing has been quite significant and mainly handled by village traders for shipment to township retailers via wholesalers in the case of charcoal, while fuelwood has been supplied from village traders directly to township retailers. The major charcoal producing areas comprise the Pathein and Myaung Mya districts for consumption in Laputta and Bogalay Townships.

Nipa thatching is collected by village traders and supplied to township retailers. In the case of marketing nipa thatching to Yangon city, producers in the reserved forests or village traders transport directly to wholesalers in Yangon. Nipa thatching prices in Laputta and Bogalay Townships, and Yangon are shown below.

Knitted bamboo wall is sold in Laputta and Bogalay Townships is transported mainly from Bago division. The retail price of a knitted bamboo wall is 9.7 – 11 kyat/ft² in Laputta and Bogalay Townships and 36 kyat/ft² on average in Yangon.

The prices of woodfuel at the different marketing stages are shown below.

Wholesale and Retail Prices of Woodfuel

Woodfuel	Area	Producer	Wholesaler	Retailer
Charcoal (kyat/kg)	Laputta and Bogalay			
	Dry season	nil	nil	91 *
	Rainy season	nil	nil	104-110 *
	Yangon			
	Rainy season	91	110	110-136
Fuelwood (kyat/kg)	Laputta and Bogalay	5-6	7-8	10-12
	Yangon	nil	n.a.	21

Source: Interview in Bogalay market, FD and Charcoal shop November 2004

Note * Price in Laputta

**Yangon fuelwood is a by-product of the timber mill 35ks/ 1.64 kg (viss).

Wholesale and Retail Prices of Nipa Thatching

(Unit: kyat/thatch)

Area	Producer	Village Trader	Wholesaler	Retailer
Laputta and Bogalay	2.0	7.5	-	10.0
Yangon	2.0	-	12.0	14.0

Source: Interview survey, 2002. Wholesale and Retail.

(2) Agricultural Products: Paddy prices

The large farmers sell their surplus paddy to local collectors/millers and earn cash income required for household necessities. Similarly, the medium farmers also sell a limited quantity of food grains during the harvesting period of paddy to solve the household cash crisis and buy some needed items. However, there are many cases in which farmers sell all harvested paddy and procure food requirements (inferior quality of rice or broken rice) of their livelihood from the local markets.

The total paddy purchased by the Myanma Agricultural Products Trading (MAPT) within Laputta in 2001/02 was 64,060 tons (3,050,460 baskets in local weights), 39.2% of which was procurement from the study area (reserved forests), while that in Bogalay was 60,868 tons (2,898,495 baskets), 56.8% of which was supplied from the study area (reserved forests). In 1998/99, the total paddy purchased by MAPT in the country was 1.9 million tons or 14% of the total national production. If adopting this rate of purchase by MAPT, it can be estimated that 179,368 tons and 246,950 tons were produced in Laputta and Bogalay respectively in this period.

(3) Fishery Products

In the study area, major marketing activities of fish and shellfish have been quite significant and mostly handled by village traders for their shipments to either the local markets in Laputta and Bogalay Townships or to the Central Fish Market (wholesale market) managed by the Yangon City Development Council in Yangon via township wholesale/prawn purchasing centers in the case of prawn trading. Crabs, especially mangrove crabs, are

transported directly to the wholesale markets in Yangon (there is no surplus crab harvest supplied to the township local markets) by village traders or crab purchasing centers established in mid to large-sized fishing villages.

Wholesale and retail prices of fish and shellfish are indicated in the table below.

Area	Price	Hilsa (kg)	Seabass (kg)	Freshwater Prawn (kg)	Tiger Prawn (kg)	Crab (Female) (Num.)	Crab (Male) (Num.)
Village	Fishermen Trader	1000-1500 2400	800-1700	3200	2500	250-450	150
Laputta and Bogalay Townships	Wholesale Retail	3000	2600	4200-6200	4200-6000	450	300
Yangon	Wholesale Retail	4000 -	2600 -	6500 7500	7500 -	750	500

Note: Fish and shellfish are medium sized except crabs with a large size.

Source: Interview at Sea Food Co. LTD, Bogalay Township (2002).

In particular, crab prices vary significantly with size, as well as seasonally and daily, while fish prices are almost constant throughout the year. Crab trading and catching are, therefore, prone to risk.

Fishery marketing in the study area is summarized in the table below.

Fishery Marketing

Reserved Forest	Direct Sales (%)					Village Traders (Middlemen) (%)				
	Total	Laputta	Bogalay	Yangon	Others*	Total	Laputta	Bogalay	Yangon	Other*
Laputta Township:										
Kyakankwinpauk	5.4	0.0	4.5	0.0	0.9	94.6	61.5	0.0	28.1	5.0
Pyinalan	19.2	0.0	0.0	0.0	19.2	80.8	57.0	0.0	0.0	23.8
Sub-total	12.2	0.0	2.3	0.0	9.9	87.8	59.2	0.0	14.3	14.3
Bogalay Township:										
Kadonkani	0.7	0.0	0.0	0.7	0.0	99.3	0.0	16.8	51.1	31.4
Pyindaye	9.2	0.0	0.4	3.6	5.2	90.8	0.0	0.0	0.0	90.8
Sub-total	4.8	0.0	0.2	2.1	2.5	95.2	0.0	8.8	26.7	59.7
Total	8.1	0.0	1.1	1.1	5.9	91.9	26.9	4.8	21.1	39.1

Notes: 1) The above figures indicate proportions to the total full-time fishery households as 100.

2) * includes local village markets and neighboring townships.

Source: Village profile site survey, 2002.

A major marketing route is trading via middlemen where 91.9% of the full-time fishermen are engaged, and the rest by the direct sales from the fishermen to the markets. In the case of trading via middlemen, 39.1% of fishermen ship their products to local village markets and neighboring townships, followed by 26.9% for shipment to Laputta town, and 21.1% to Yangon.

Yangon

2.7.3 Household Economy Model

(1) Agricultural Household Economy Model

Results of analysis by different reserved forests for the study area are as follows:

- i) Average annual gross income for average land holding farmers in the Kyakankwinpauk Reserved Forest is about 10 times that of the Pyindaye Reserved Forest due to larger farming scale.
- ii) Average annual gross income for subsistence agriculture is larger in the Kyakankwinpauk and Pyinalan Reserved Forests in Laputta Township than in the Kadonkani and Pyindaye Reserved Forests in Bogalay Township. However, the income differential is largest between Kadonkani and Pyindaye located in the same township.
- iii) Land productivity for average land holding farmers in Kyakankwinpauk at 37,212 kyat/acres is the highest for all reserved forests while, on the other hand, that for the Pyindaye Reserved Forest amounts to half of that of the Kyakankwinpauk Reserved Forest, indicating that the average land holding of 4.9 acres cannot produce sufficient food to support the average household members of 5.3.

Within the study area, gross farm income is particularly high in the Kyakankwinpauk and Pyinalan Reserved Forests in Laputta Township due to diversified agriculture comprising cultivation of high value fruit trees and vegetable crops, and fish and prawn farming as well as much larger land holdings than reserved forests in Bogalay Township. In contrast, farm income in the Kadonkani and Pyindaye Reserved Forests in Bogalay Township is much lower (27% lower for households having an average land holding size and 72% lower for households having 3 acres of land in the case of the Kyakankwinpauk and Pyinalan Reserved Forests) and households must rely on off-farm income sources.

Limited crop production depends primarily on rain-fed agriculture, making it difficult for farm households to achieve even self-sufficiency in food production in some villages where acid soil spread is acute. Annual farm household income in the study area is summarized in Table 2.20.

The household economy survey revealed that (a) agricultural contribution was not so significant for the poor and very poor groups due to their income sources being more inclined to wage employment as agricultural and non-agricultural laborers, while economic activities such as trading and small cottage industries including rice mills were substantially greater for the high income farm groups; (b) the very poor groups were always the smallest land holders with less than 1.2ha

Annual farm household expenditure in the study area in the study area is summarized in Table 2.21.

According to the income and expenditure data, agricultural household economy model was analyzed. Results of analysis by different reserved forests for the study area are as follows:

- i) Average annual farm expenditure for the Pyindaye Reserved Forest accounts for 10% of that for the Kyakankwinpauk Reserved Forest due to the smaller land holding size.
- ii) The ratio of agricultural expenses of average annual farmer comprising of taxation and production cost to annual farm gross income is highest at 42% for the Pyinalan and Pyindaye Reserved Forests, and lowest at 25% for the Kadonkani Reserved Forest.

- iii) Annual agricultural investment for the Kyakankwinpauk reserved forest is about 10 times that of the Pyindaye, indicating that diversified agriculture is much more costly but at the same time much more profitable than mono-cultural agriculture, as well as simply involving much larger land holdings.

As the agricultural sector continues to be a major source of employment and income, and is overwhelmingly dominant in terms of labor force absorption, the introduction of market-oriented high value cropping such as fruits and vegetables to the study area constitutes a major potential for generating substantial employment and income opportunities especially for subsistence farmers.

(2) Fishery Model

The household survey revealed that full-time fishery households earned much more than the high income farm groups, while part-time fishery households (landless households) engaged in crab catching on a subsistence basis. Annual gross fishery incomes by different categories are summarized as shown below.

Annual Gross Fishery Income

Occupation	Work Content	Annual Gross Income (kyat)
Landless households	-Crab catching and nipa cutting	80,000
	-Crab catching	50,000 - 60,000
Fishery households	-Crab and shrimp catching, and small-scale net fishing	1,000,000
	-Large-scale net fishing (shrimp catching and small-scale net fishing)	800,000 - 400,000
	-Small-scale net fishing	100,000 - 120,000

Source: Interview survey, 2002.

CHAPTER 3 **PRESENT INSTITUTIONAL FRAMEWORK FOR FOREST AND FORESTRY**

3.1 National Policy and Institutional Framework

3.1.1 National Policy

(1) National Policy on Forestry

Reflecting the international trends on sustainable development, the Government of Myanmar (GOM) focuses more on the sustainability of forest production and stability of the environment through community development. The Forest Law was enacted in 1992 and subsequently the National Forest Policy was formulated in 1995. Establishment of this law and policy is a milestone for new directions in sustainable forest management.

The Forest Law of 1992 provide the legal framework to implement forest policy, and its basic principles include 1) environmental conservation, 2) public cooperation in accordance with international agreement, 3) preservation of forests and bio-diversity, and 4) conservation of natural forests and establishment of forest plantations. The Forest Rules and Regulations of 1995 have been promulgated to provide statutory guidance to implement the Forest Law, which could be developed at different stages depending upon the needs of the forest management system. The Forest Policy of 1995 provides a substantive basis for developing a workable legislative framework and afterwards the enactment of rules and regulations.

The Forest Policy formalized the commitment and intent of the government in ensuring sustainable development of forest resources, both for environmental and economic purposes. The policy identified six imperatives, ten strategic objectives and five implementation strategies to address outstanding constraints to attain the imperatives. The policy defines six imperatives listed in the following table, taking account of the national goals, objectives, and a broader context of the country's economy and society.

Six Imperatives of the Forest Policy

- | |
|--|
| <ol style="list-style-type: none">1) PROTECTION of soil, water, wildlife, biodiversity and environment,2) SUSTAINABILY of forest resources to ensure perpetual supply of both tangible and in tangible benefits accrued from the forests for present and future generations,3) BASIC NEEDS of the people for fuel, shelter, food and recreation,4) EFFICIENCY to harness in the socio-environmentally friendly manger, the full economic potential of the forest resources,5) PARTICIPATION of the people in the conservation and utilization of the forests,6) PUBLIC AWARENESS about the vital role of the forests in the well being and socioeconomic development of the nation. |
|--|

The policy listed the following ten strategic objectives to address outstanding constraints to

attain the prescribed imperatives.

Ten Strategic Objectives of the Forest Policy

- 1) promoting appropriate land use practices,
- 2) strengthening of forest protection and management,
- 3) accelerating forest regeneration and reforestation,
- 4) reinforcing the forest industry, marketing and trade,
- 5) augmenting the forestry research program,
- 6) initiating sustainable development planning in the forestry sector,
- 7) promoting inter-sector coordination related to forestry,
- 8) strengthening the forestry institution,
- 9) increasing funding and investment in forestry, and
- 10) raising peoples' participation and public awareness for people-based forestry development.

Moreover, the Forest Policy has the following five recommended implementation strategies.

- 1) reorganization of the forestry service,
- 2) increased investment and funding in the forestry sector,
- 3) amendment to present legislation,
- 4) launching of a massive information and public awareness campaign,
- 5) strengthening of inter-sector linkages,

(2) National Policy and Development Plan on Agriculture

As agriculture plays a vital role in the Myanmar economy, agricultural development activities are given the highest priority among all sectors. Short-term agricultural production plans have been launched since 1992 by Ministry of Agriculture and Irrigation (MOAI) with the mandates on surplus of paddy production, self-sufficiency in edible oil, and increased production and export of industrial crops. In order to achieve the mandates, MOAI adopted five reform measures namely, 1) Development of new agricultural land, 2) Provision of sufficient irrigation water, 3) Provision of support for agricultural mechanization, 4) Application of modern technologies, and 5) Introduction of modern technologies.

(3) National Policy on Fishery

The GOM placed fishery at second priority among the economic production sectors in the Five Year National Plan (1996/97-2001/02) in 1996. In accordance with the plan, the 30-year national fishery master plan (2002/03 - 2031/32) was promulgated in 2002. The following five objectives are declared in the master plan:

- 1) To promote and develop rural based fish and prawn culture;
- 2) To promote joint venture business with foreign enterprises for the prawn culture;
- 3) To promote sustainable environment conservation;

- 4) To promote integrated development of the fishery sector without destroying the environment; and
- 5) To promote participation of fishermen widely for sustainable development of the fishery sector.

In connection with the 30-year national fishery master plan, the Fishery Department under the Ministry of Livestock and Fishery (MOLF) consolidated fishery activities by formulation of the following agencies 1) Livestock and Fisheries Development Bank and 2) Myanmar Fisheries Federation. The Livestock and Fisheries Development Bank has a responsibility to provide low interest loans for investment in the fisheries business. The Myanmar Fisheries Association (MFA) was formed in 1994 originally and reformed as the Myanmar Fisheries Federation in 1998. The objectives of Myanmar Fisheries Federation are described in Table 3.1.

(4) National Policy on Environment

The GOM formed the National Commission for Environmental Affairs (NCEA) in February 1990. The National Commission for Environmental Affairs (NCEA) is an organization responsible for natural environment and biodiversity conservation activities through coordination among concerned government departments and related organizations as well as through cooperation with related international organizations. However, the NCEA has not appeared to be particularly active through the study period in areas such as enactment of ordinances in environment or social assessment.

The Natural Environmental Conservation Committee is one of the four committees under NCEA. On May 19, 2004, the committee announced and formulated 10 special task implementation groups for effective environmental conservation. The announcement declared the formulation of ten environmental conservation special task implementation groups that were categorized to four river groups, one coastal group and five forest groups. These groups are shown in Table 3.2.

The Prime Minister is appointed as the president of the Special Task Implementation Groups. Other appointed members to the implementation group, such as ministry offices, departments and the police, are presented in Table 3.3. The Ministry of Forestry is appointed as a representative member of environmental conservation special task implementation groups. Also the responsibility of the implementation groups that are provided by category of the groups is provided in Table 3.4.

3.2 Institutional Framework of the Ministry of Forestry

3.2.1 National Institutional Framework of Forestry

(1) Forest Law

Reflecting the trends on sustainable development, concern for the environment, and the situation of the economy in the country, the former Forest Act of 1902 was replaced with the new Forest Law enacted in 1992. The Forest Law comprises 58 articles under 13 chapters. The revised law highlights forest reservation and protection, management of forest land, establishment of forest plantations, extraction and removal of forest produce, establishment of wood-based industry and administrative action in respect of offences and penalties. The Forest Law also emphasizes people participation in forest management and private sector involvement in forestry sector development.

The Forest Law defines a reserved forest under Articles 4 and 6 in chapter III: Constitution of Reserved Forest and Declaration of Protected Public Forest. According the article, the reserved forest is an area to conserve the environmental factors and to maintain a sustained yield of forest products. The Ministry of Forestry may, with the approval of the Government, constitute the following categories of reserved forest by demarcating land at the disposal of the Government:

- 1) commercial reserved forest;
- 2) local supply reserved forest;
- 3) watershed or catchment protection reserved forest;
- 4) environment and biodiversity conservation reserved forest;
- 5) other categories of reserved forest.

The Forest Law also defines the activities that cannot be allowed in the reserved forest, and the person that violates the act can be punished in accordance with Articles 40 and 42 of Chapter VI concerning 'Offences and Penalties'. More specifically, the person that may violate the regulations may be punished with a fine up to 5,000 kyat or with imprisonment up to six months or with both, for violation of the acts described in Table 3.5.

Also, Article 42 is subjected to commitment to be punished with a fine up to 20,000 kyat or with imprisonment up to one year or with both, for violation of the following act.

- 1) Felling, cutting girdling, marking, lopping, tapping or injuring by fire or otherwise any tree in a reserved forest

Also, the Forest Law prohibits construction of charcoal kilns and making charcoal without a permit and charges up to 20,000 kyat of fine or imprisonment up to 2 years or both for a violation.

(2) Organizational Structure

The Ministry of Forestry (MOF), which was reformed in 1992 to develop and strengthen the national forestry sector, comprises four main departments, as of December 2004.

- 1) The Planning and Statistics Department coordinates and facilitates the tasks of FD, the Myanmar Timber Enterprise (MTE), and the Dry Zone Greening Department (DZGD) following the directives of MOF, and deals mainly with policy matters and issues related to forestry,
- 2) FD is responsible for protection, and conservation of biodiversity and sustainable management of the forest resources of the country,
- 3) MTE is responsible for timber harvesting, milling and downstream processing and marketing of forest products, and
- 4) Dry Zone Greening Department is responsible for reforestation of degraded forest lands, protection and conservation of remaining natural forests, and restoration of the environment in the dry zone of Central Myanmar.

The Planning and Statistics Department is a coordination department among the three departments, MTE and the MOF. Originally, the Survey Department responsible for carrying out surveying work to meet the needs of other departments was positioned under the MOF. Currently, the department has been shifted to a position under the Ministry of Agriculture and Irrigation.

(3) National Forestry Sector Master Plan

The Forest Policy set the basic directions of the 30-year National Forestry Sector Master Plan (2001/02 – 2030/31). This is a strategic and broad blueprint of all development and management related to forestry resources in the country. Originally, the national forestry sector master plan had adopted one of the master plans formulated as an output of the “Sustainable Forest Resource Management Project ” by FAO in 1992. At the preface of the plan, it said that “the Plan has many flaws due to unexpected circumstances so the plan will need to be edited and updated in conformity with the current situation”. In this connection, the revision of the plan has been being carried out since early 1995, and the amendment of the plan was approved in 1998 by the committee comprising the PSD, FD, and MTE. At present, the Plan is adopted as the national plan regarding forests and forestry in Myanmar.

(4) Forest Management Plan

In principle the concept of sustainable forest management originates with the “Myanmar Selection System”. In addition to the system, the modern forest management plan, based on the indicators of annual forest yield and volume of extraction assuming the felling cycle of 30 years, was introduced in the 1920’s. The following table summarizes a history of forest

management plans in Myanmar, based on the understanding of the study team. The documentation of forest management plans originates in the 1920's at forest divisional level, by preparing a divisional working plan (Section 4.1.1 explains about the forest division). The working plan at forest divisional level had been updated every 10 to 15 years. However, during the 1970's to 1995, the study team could not confirm the existence or update of the forest management plan. In 1992, the original national forestry sector master plan was adopted. Based on this master plan, each district shall prepare its forest management plan to carry out the strategies in developing and managing forest resources covering certain jurisdictional and time frames. In 1995, all district forest management plans could be developed (for all administrative districts). The forest management plan at a lower level than the district level could be prepared as 5-year and annual plan for designation of practical activities by township FD offices which specify attainable targets, in accordance with the district forest management plan and instructions of higher offices. However, the actual 5-year plan in writing is not obligatory and could not be found by the study team.

Transition of Myanmar Forest Management

Management Level	before 1970	1970 – 1991	After 1992
National	Not prepared	Not prepared	1992: National Forestry Sector Master Plan (2001-) 1998: Revision of the master plan
Forest Division	1924 - Divisional Working plan 1934 - Divisional working plan	Not prepared	Not prepared
District (administrative unit)	Not prepared	Not prepared	1996 District Forest Management plan (61 districts)
Lower Level (administrative unit)	Not prepared	Not prepared	Annual plan / five year plan

Sources: Forest Department, 2004.

(5) Application of Forest Law and Regulations

The Forest Law of 1992 has consolidated and clarified several issues raised in the previous legislation. Aside from the efforts of GOM, there were a number of assistance efforts in rural community development given by donor agencies and NGOs, which focused on the Community Forestry (CF) development. The government also appropriated funds for the establishment of village wood lots and FD designated about 94,000 ha of land for this purpose from 1988 to 1999. In 1998 alone, FD and the Dry Zone Greening Department achieved about 17,000 ha of village wood lot plantation.

(6) Local Supply and Community Participation

In order to satisfy the increasing local demand for fuel wood, the Forest Law (Chapter V, Article 15) stipulates to legalize wood lots for the use of the villages on state-own land close to the villages. In accordance with this enactment, FD issued the Community Forestry

Instructions (CFI) in 1995. As per instructions, local communities who systematically plan and establish wood lots are given a 30-year land use right for forest management. The community owned woodlot can be planted and used even in the reserved forest areas.

The participation of local communities is encouraged in the management of the local supply in reserve forests and protected public forests. Work areas for local supply in the reserved forests are being formed in all states and divisions of the country in accordance with the district forest management plans. The local communities are required to plant trees in each homestead garden. Growing trees in homestead gardens is a traditional practice in rural areas of Myanmar. Both natural forest conservation and forest plantations can be considered in CF.

The National Forestry Sector Master Plan (2001/02 –2030/31) identified 4 major forestry activities that required involvement of local communities:

- 1) Involvement and participation in management of local supply reserved forests and protected public forests,
- 2) Participation in tree planting,
- 3) Participation and management in agro-forestry activities, and
- 4) Involvement and participation in state owned forest management.

The Local supply reserved forests and the protected public forests are established to make forest products available for local needs such as building and farming materials. Previously, the local supply reserved forests were encroached on for expansion of farmland and some areas had completely disappeared. Presently, these areas are targeted for restoration in accordance with the district forest management plans. The 30-year plan suggested a proper strategic management action for these areas is summarized in Table 3.6.

3.2.2 District Institutional Framework of Forest Department

In this context, 10-year district forest management plans of the Myaung Mya and Pyarpon districts from 1996/97 to 2005/06 was prepared in 1996 based on the instruction of the director general of the FD and the guideline for the preparation of a district forest management plan. Table 3.7 gives details about the format of the guideline for development of the district forest management plan. The plans set a target area of 433.35 thousand ha (1.07 million acres) i.e. ten reserved forests: Pyindaye, Kadonkani, Kalayaik, Kakayan, Labutkwe, Nyi-naung, Pyinalan, Kyaukkon, Kyakankwinpauk, and Lebyauk and one wild life sanctuary of Meinmahla.

The responsible agency for the implementation of the management plan is FD and the budget for fulfillment of the following target is estimated as 24.22 million kyat as of regular

annual budget for the first five years. The management plan defines the following working circles/protected area and target areas in the Myaung Mya and Pyarpon districts.

Targeted Working Circle/Protected Area in the Myaung Mya and Pyarpon Districts

Working Circle/ Protected Area System	Target Area	
	ha	acre
1) Production Working Circle (Natural Production Forest)	48,510.5	119,779
2) Local Supply/Community Forests Working Circle (Local Supply / Community Forests)	144,642.5	357,142
3) Special Working Circle (Mangrove Forest Rehabilitation Working Circle)	50,851.0	125,558
4) Protected Areas System (Meinmahla Wildlife Sanctuary)	13,680.5	33,779

Source: District Forest Management plans of the Myaung Mya and Pyarpon districts (1996/97 to 2005/06)

The second and third activities of the above plan are directly related to the study area in respect of the mangrove rehabilitation and CF. In principle, a working circle is an area organized with a particular object and under one silvicultural system, and one set of working plan prescriptions. The working circle is an aggregate of forest compartments and each of the four working circles has the following characteristics.

Production working circles are designated mainly for sustainable production of marketable timber and conservation of well-stocked natural forests. However, no harvest or yield is planned during the current district forest management plan. In reality, compartments under this working circle are aimed at rehabilitation and not to function as a production working circle. Local supply community forest working circles, comprising nearly half of the total area of the study area, are designated, mainly, for contribution towards fulfilling the basic needs of the local people. The establishment of plantations and protection/improvement of natural forests are planned to be implemented, mainly by people's participation. Mangrove rehabilitation working circles are categorized as the special working circle designated for mangrove areas to protect and rehabilitate an invaluable mangrove forest ecosystem that needs urgent measures against degradation.

In general, protected areas are designated for ecosystems, wildlife conservation, and, in the study area the Meinmahla, Reserved Forest is the declared as wildlife sanctuary. Limited utilization of mangrove resources is permitted in Meinmahla to protected wildlife as well as forest resources.

3.3 Institutional and Administrative Framework of the Forest Department

3.3.1 Functions and Responsibilities of the Forest Department

The Forest Law mandates to FD eight functions and responsibilities shown in the following table.

The Mandate of Forest Department

- 1) implementation of the forest policy of the Government,
- 2) implementation of the plans relating to conservation of water, soil, biodiversity and environment,
- 3) management of forestland in accordance with the provisions of the law,
- 4) submitting proposals to the Minister for the determination, alternation or cancellation of reserved forest, protected public forest and species of reserved trees,
- 5) establishing and managing schools and training courses relating to forestry and sending trainees abroad,
- 6) administering the forestry institute,
- 7) inventorying forest resources, and
- 8) carrying out forest research.

The forest lands under the management of FD subject to these mandates are reserved forests and public protected forests. Public protected forest is delineated on national land outside reserved forests for the following specified purposes.

- 1) protection of water and soil,
- 2) conservation of arid-zone forests,
- 3) conservation of mangrove forests,
- 4) conservation of environment and biodiversity, and
- 5) conservation of sustainable production.

Also, the FD Director General office can establish plantation sites on or outside of the forest lands, with the approval of the Minister.

3.3.2 Organization

(1) Organization of FD

The FD is the second largest department in the Ministry in terms of staff (15,148) following the Myanmar Timber Enterprise (47,984 staff), with the Director General Office, 14 state/division offices, 47 district offices, and 316 township offices. The organization of FD addressed under the Ministry of Forestry is shown in Figure 3.1: Organization Chart of FD.

From the viewpoint of functionality, there are three types of organization: regular organization, ad-hoc organization, and special organizations. Regular organizations are: Director General's Office, and regional offices like FD divisional office, FD district office, FD township office. Routine operation of the regular organization is carried out by transmitting directives from the upper echelon of the structure to the lower.

Meanwhile, an ad hoc organization has been formulated by the Director General of FD for

operating special projects. The ad hoc organization under the Director General Office of FD is set up based on the permission and instruction of the Ministry of Forestry. So far, ad hoc organizations have been set up for projects like, Inle Lake 20 miles Greening National Project, Mangrove National Project, Central Dry Zone Greening Project, etc. The statuses of ad hoc organizations are recognized as higher than the district FD office.

Special organizations at the township FD office are set by order of the state/division FD office such as the forest camps beside a beat office under the township FD office. The Bogalay Township FD Office formulated 13 forest camps at the Kadonkani Reserved Forest for implementation of “Integrated Resource Management”.

(2) Career development for FD Staff

There are two types of job classification in FD: managerial and technical. Graduates from the Forestry University are normally assigned as a “range officer” when they enter FD. They promote to staff officer after about 10 - 15 years from their enrolment with FD. Officers in the management class experience a position change every two to three years in principle. The job rotation is normally carried out by issuing an order of the Director General of FD, with permission of the Ministry of Forestry. On the other hand, staff in the technical class such as range officers and below, office clerk, and workers engages in daily operation under the management and supervision of the managerial officer. The following table summarizes the job classification of FD. Position change for the range officer is infrequent when comparing with the frequency of change for the staff officer, because of engagement in technical activity such as forest plantations.

Job Classification of the Forest Department Staff

Managerial	Technical
Director General	Range Officer
Deputy Director General	Deputy Range Officer
Director	Forester
Deputy Director	Forest Guard
Assistant Director	Clerk
Staff Officer	Worker

3.3.3 State/Division and District Offices of the Forest Department

The study area is under the management of the following FD regional offices.

- The FD Ayeyawady Division Office,
- The Myaung Mya District FD Office, and
- The Laputta and Bogalay Township FD Offices.

The FD state and division offices subordinate to Director General’s Office of FD headquarters and the FD district office is placed under the state or division office. Those FD

divisions or state and district offices ordinarily function as management and operation offices under the Director General's Office of FD and the Peace and Development Council of the district, division or state. Under the district FD office, the township FD office is organized as an implementation office.

In general, the FD offices at state/division, district and township are responsible for 1) the management of a reserved forest and a public protection forest, 2) plantation and 3) revenue collection in accordance with the instructions from the Directors-General Office of FD.

Actual responsibilities of the district FD office relates to the obligations in the following table.

Obligations of the District FD

- | |
|---|
| <ol style="list-style-type: none">1) Preparation of an annual activity plan such as development of plantation, community forestry, charcoal production, etc in collaboration with the division FD office,2) Distribution of the annual activity plan to the township FD offices,3) Seedling supply for greening of the district and township area based on instruction from DPDC,4) Seedling supply for school plantation activities based on a request of a PTA,5) Seedling supply for the area's greening activity based on a request from a women's federation,6) Control of illegal forest production and transportation in collaboration with the division and township FD offices, and7) Reporting results of the activities to the division FD office and the Director General Office of FD. |
|---|

3.3.4 Organizations of the FD in Laputta and Bogalay Township

The FD offices in the Laputta and Bogalay Townships with jurisdiction over the study area are under the administration of the Myaung Mya District FD Office that administers township FD offices of the Myang Mya and Pyarpon Districts. The Laputta Township FD has jurisdiction over Kyakankwinpauk and Pyinalan Reserved Forests while that at Bogalay has jurisdiction over the Kadonkani, Meinmahla and Pyindaye Reserved Forests.

The Laputta and Bogalay Township FD Offices are composed of the following numbers of officers and field staff at each position in the year 2002 when the study was commenced and in 2004 respectively. Also, the township FD offices hire workers for development and management of plantations that are operated directly by the FD offices. The number of workers of the township FD office varies depending on the work quantity of such a direct operations. At the time of the study, Laputta Township FD office maintains 180 household workers for both Kyakankwinpauk and Pyinalan Reserved Forests.

The responsibility of the staff officers (township officers) is to manage township offices. The staff officer or township officer is mainly selected from the graduates of the Institute of Forests (the institute was changed to the Forestry University in 1995) under the FD. The range officer is also a graduate of the Forestry University or non-graduate (in frequent case) who is charged with the practical implementation of the duty at site together with the field staff. In this report, for convenience, FD staff who are range officers and above are called

the “officer”, and deputy range officers and below are called the “field staff”. Normally, the field staff is assigned at township FD offices and/or field stations (FD camps and beat offices) within a township.

Officer and Field Staff of Laputta and Bogalay Township FD Offices

Position	FD Laputta township office		FD Bogalay township office	
	Aug. 2002	Oct. 2004	Aug. 2002	Oct. 2004
Officer				
Staff Officer (SO), Township Officer	1	1	1	1
Range Officer (RO)	2	3	2	3
Field Staff				
Deputy Range Officer	10	9	9	8
Forester	17	14	18	15
Forest Guard		4	3	11
Office staff/clerk	5	4	11	8
Total No of Officers and Staff	35	35	44	46

Source: Planning and Statistics Department, FD 2004

Superior agencies of the township FD offices are the Myaung Mya District FD Office and the peace and development council of the townships. Based on instructions from such organizations, township FD offices are engaged in the following activities:

- direct forest plantation operation,
- revenue collection,
- management and support of the community forestry activities,
- supplying seedlings to township greening activities,
- controlling fires and illegal felling and removals,
- repairing,
- for land utilization within the reserved forest areas, and
- for forestry products sales and marketing business.

The FD offices at township level are responsible for forestry activity within the area belonging to the township. However, the major work of the FD township office is focused to inside the reserved forest. The reserved forests are divided into “beats” that is sub management units of township FD offices. Each beat has an FD office and an FD beat officer is assigned by the township FD office. The duties of the beat office are mainly for revenue collection and forest plantations.

Also Laputta Township FD office maintains three forest camps in Kyakankwinpauk Reserved Forest and also three camps in Pyinalan Reserved Forest, and Bogalay Township FD Office maintains thirteen forest camps in the Kadonkani Reserved Forest, and five camps in Pyindaye Reserved Forest, and seven camps in Meinmahla Reserved Forest¹.

¹ Forest camps in each reserved forest are as follows. Kyakankwinpauk Reserved Forest(3): Shwe Kyun Tar, Kwa Kwa Ka Lay, Mi Kyaung Thaik / Pyinalan Reserved Forest(3): Nga Phone, Gway Chaung, Thar Yar Kone

Of the respective two range officers of each township FD office in February and March 2002, 1) one officer was responsible for a mangrove project plantation, conservation and community forestry management and support staff, while 2) the other was responsible for revenue collection for paddy, nipa cultivation and permission fees for land utilization for homestead gardening (coconut) within reserved forests, revenue collection on nipa thatch roofing materials and phoenix pole traders, as well as revenue collection on forest products, sales shops and timber mills within the township.

Meanwhile, in April 2004, a change order was made by the Ayeyawady Division FD Officer. The responsibility of the range officers under the Ayeyawady Division FD Office was changed based on the instruction and the range officers were assigned to one reserved forest each. Thus the one range officer who was assigned to a certain reserved forest has to fulfil not only mangrove plantation management, but also conservation activity, management and support of the community forestry, and revenue collection.

Actually, revenue is collected by deputy range officers and foresters under the management of the range officer on site. For engagement in forestry products related business, a license is mandatory with the issuing authorities and it differs depending on the scale of the production. For example, in the case of large-scale timber milling, the required license is issued by the division/state FD office. In the case of small-scale forest product marketing, the required license is issued by the township FD office.

Organization charts for mangrove plantation and conservation projects within Laputta and Bogalay Townships are indicated in Figure 3.2: Organization Chart of Laputta and Bogalay Township FD Offices, October, 2004.

3.3.5 Budget

(1) Forest Department

The annual budget of FD for the fiscal year 1996 to 2003 is shown in the following table prepared by the Planning and Statistics Division (PSD), FD. The budget has increased almost four times when comparing the budget between 1996 and 2003. Current expenditure was increased almost 5.2 times between 1996 and 2003, while capital expenditure was raised 3.1 times. This tendency shows the greater increase of current budget such as salary, administration cost, and so on than the lesser increase of capital expenditure.

/ Kadonkani Reserved Forest(13): Byone Hmwe West, Byone Hmwe East, Me Laung Kwin, Byuyagon, Lay Gwe, Chaung Bye Gyi, Paukseik Kya, Nyan Kwin, Thone Thet Kone, Ma Kyin Myaing, Japan Kyun, Hmone Daing, and Tha Bet Gyi / Pyindaye Reserved Forest(5): Set San, Te Bin Seik, Amar, Nauk Mee, and Kattaing / Meinmahla Reserved Forest(7): Kyaung Daunk, Mi Kyaung Gaung Poke, Tawbaing, Po Laung Gyi, Thaug Chaung, Tha Phya Chaung, and Dami Taung

Forest Department Annual Budget

Unit: Million Kyat

Year	Expenditure			Income
	Current	Capital	Total	
1996-97	347.146	354.858	702.004	532.184
1997-98	396.708	363.083	759.791	980.093
1998-99	457.724	388.237	845.961	1,082.216
1999-2000	574.509	641.859	1,216.368	1,308.218
2000-2001	1,310.803	618.232	1,929.035	1,585.006
2001-2002	1,433.139	724.858	2,157.997	1,690.551
2002-2003	1,496.169	839.253	2,335.422	1,578.319
2003-2004	1,834.506	1,102.692	2,937.198	2,083.353

Source: PSD, FD, 2004.

(2) Myaung Mya District Forest Department Office

The annual budget of the Myaung Mya District FD Office for fiscal year 2004 is estimated at around 35,000,000 kyat for current and capital budget, depending on the district FD officer. The budget includes both ordinary budget such as administration or salary and project budget such as IRM and FD plantation.

(3) Laputta and Bogalay Township FD Offices

The annual budget for fiscal year 2002 for mangrove national projects including nursery expense was 4,511,000 kyat (520 ha plantation) in the case of Laputta and 4,164,000 kyat (480 ha plantation) in the case of Bogalay.

3.4 Community Forestry Instruction

3.4.1 Outline of the Community Forestry Instruction

(1) Objectives

In December 1995, the Community Forestry Instruction (CFI) was ordered by the director general of FD. The CFI is constituted based on article 15, chapter V, Establishment of Forest Plantation in the Forest Law. The article 15 states that the FD may permit the establishment of village woodlots within a reserved forest near the villages or in the protected forest outside of a reserved forest or on other land at the disposal of the state. The community forestry is defined by the CFI as "Forestry operation in which the local community itself is involved; such as: 1) establishment of woodlots where there is insufficient fuelwood and other products for community use, and 2) planting of trees and exploiting forest products to obtain food supplies, consumer products and incomes at farmer level".

The objectives of the CFI are: 1) supporting the economic development of the country, 2) regaining environmental stability, and 3) addressing the basic needs of local communities.

(2) Role Sharing of CF Activity between FD and CF User Groups

Stakeholders of CF activity are principally FD and CF user groups that are formulated by dwelled villagers as an entity to undertake responsibility for implementation of CF activity. The responsibility of FD is management and support of the implementation of CF activities by the CF user groups. The CF user group has to implement the CF activity in accordance with the CF management plan that they prepared by themselves and had been permitted by FD.

The duties and responsibility regarding CFI is devolved to the assistant director at the district FD office by the director general of FD in compliance with Article 15 of the Forest Law. Under the district FD office, CF activity is being implemented through collaboration between district and township FD offices and the CF user groups. The following table presents a role sharing of CF activity between FD and CF user groups.

Role Sharing of CF Activity between FD and CF User Groups

Forest Department	CF User Groups
Preparatory Stage	Preparatory Stage
<ul style="list-style-type: none"> • Promotion of CFI • Allocation of CF area • Supports preparation of application • Supports preparation of management plans and drawing maps • Issuing CF Certificate 	<ul style="list-style-type: none"> • Confirmation of allocated CF areas • Formulation of CF user group / management committees • Preparation of applications • Preparation of rules and regulations of CF user groups • Preparing management plans, drawing maps
Implementation Stage	Implementation Stage
<ul style="list-style-type: none"> • Production and supply of seeds/seedlings for planting of the first rotation to CF user groups • Supply necessary technical know-how • Supply necessary managerial know-how of the CF user groups such as issuing sales voucher, preparation of progress reports, etc. • Monitoring the activities through monthly and annual progress reports • Assisting arbitration • Registration of sales vouchers and issuing removal passes • Management of the CF activities and • Reporting 	<ul style="list-style-type: none"> • Implementation of CF activities in accordance with certified CF management plans, • Protecting and conservation of CF areas where there are remaining forests and seedlings are available, • Management of landmarks and border lines of CF areas • Protecting CF areas from illegal felling, girdling, pruning, debarking and tapping • Protecting the CF area to be utilized other than forests, • Utilization of the forest products without waste and in conformity with regulations, • Printing sales vouchers, • Observing strictly the prescriptions of the management plan, • Maintaining CF implementation records and meeting minutes, • Preparing progress reports about CF activities, • Submission of the progress report to the FD.

(3) Flow of CFI Procedure

Figure 3.3 shows the overall flow of the CF activity that is defined by the CFI. Figure 3.4: in the attachment depicts the full procedure of the CF activity including responsibility of all related agencies i.e. Director General Office of FD, District FD Office, Township FD Office, and CF user group including CF management committees undertaking management of CF user groups. The CF operation is divided into two stages, namely, the preparatory and implementation stages and the operation and management stages. The CF activity is

initiated by the site selection of the CF activity by the township FD office based on confirmation of villagers' intention for participation in the CF activity. Then the villagers who have intended to start the CF activity, formulate a CF user group and a management committee. The CF user group prepares an application for participation in CF activity based on the CF area allocated by the FD. The CFI instructs that the user group is to prepare a CF management plan and CF maps for application of the CF activity. Normally it takes about 6 months to obtain a CF certificate after the allocation of a CF area.

In accordance with the progress at the implementation stage, the CF user group practices the CF activity based on the submitted CF management plan. During the implementation stage, the CF user group harvests the products, and surplus production can be merchandized. The selling to outside townships has to be traded with a sales voucher and a removal pass. The sales voucher is issued by the CF user group and registered by the township FD office. The removal pass is printed by a trader who is going to purchase and sell the CF products outside of the township where the product is produced.

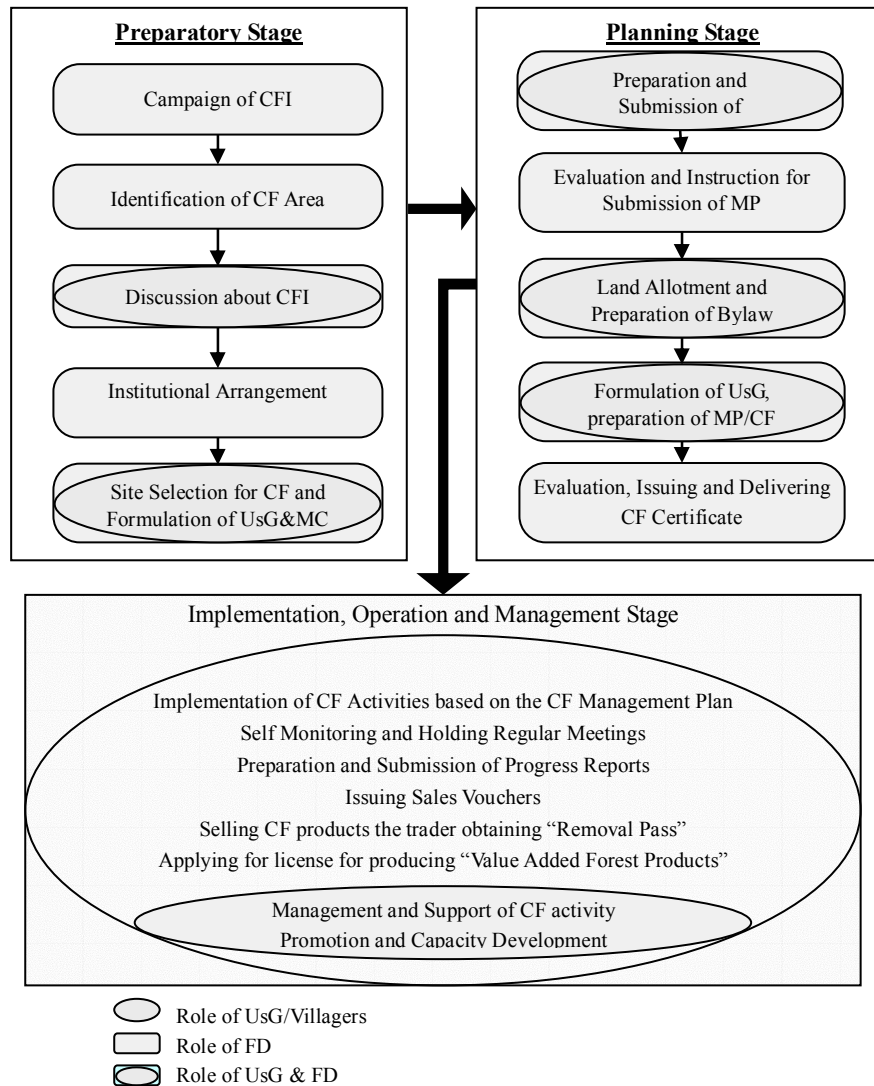


Figure 3.3 Overall Procedure, Role of UsG and FD and Activities

3.4.2 Institutional System and Mechanism of the Community Forestry Activity

(1) Institutional System of CF Activity

The Forest Law highlights needs for environmental and biodiversity conservation. It also encourages involvement of the private sector and community participation in managing the forest resources in order to satisfy the basic needs of local people.

FD has already realized the importance of extension services to rehabilitate the degraded forests and to introduce CFI attaining sustainable use of limited natural resources through community participation. The Forestry Extension Division, established in 1995, is responsible for the central level forestry extension activities such as development leaflets for public awareness. The Central Forest Development and Training Center (CFDTC) under the Training and Research Development Division is working on training government

staff and villagers. At the site for the extension of CFI, there are no specialized staffs assigned at the state/division, district or township FD office. In the study area, township FD officers and field staffs are working on extension of CFI.

Though the township FD office is the office charged with propelling the CF activity, the township office is not being allocated any kinds of budget for CF activity i.e. promotion of CF activity, support planning, granting CF certificates, technical or managerial support. Surplus seedling production is usually distributed to CF user groups. Thus, FD relies on donor's support for CF activity, so in reality, CF activities are located where donors are supportive in Myanmar.

(2) Mechanism of CFI

The CFI instructs the formulation of the CF user group and management committee within the group for administration of the CF user group. There is no definition about minimum numbers of CF user group members on the CFI. However, at least five members are necessary for formulation of the management committee (i.e. chairman, secretary and three committee members). Thus the CF certificate is granted to a CF user group, and not to an individual CF user group member. Meanwhile, the CF user group can be engaged in CF activities either as an individual or a group.

The CF area must be forest areas allocated either within or outside the reserved forest. It is prohibited to utilize the CF area other than for forestry. This means that the expansion of the CF area is increasing forest cover directly and all kinds of forestry can be applicable such as agroforestry, aqua-agroforestry, windbreaks, compost woodlots, school woodlots, village woodlots, etc., as long as the CF activities are forestry and there is no land use change in the CF area as forest.

The first incentive for the CF activity to CF user group members is land use right for 30 years that is extendable for another 30 years. A secondary incentive is that the CF user group member expects profits through the CF activities. The land use right is an immediate incentive for the user group, especially for casual laborers who are usually landless. However, the CF activity cannot earn profit in the short term. Usually the CF user group in the study area is in a poor condition, because of no stable job opportunity year-around or a single income source. Therefore, the CF activities have to be an economical foundation for the CF user group member attaining diversification of economic activity.

The district management plans (1996/97-2005/06) of the Myaung Mya and Pyarpon districts stated that the public participation should consist of 1) utilization of the multipurpose zone to establish community forests, 2) agroforestry, 3) agriculture, 4) animal husbandry, and 5) fishery practice with no environmental damage to forests. The statement can be interpreted as a diversification of CF activities. Thus, the CF management plan

updated in the pilot project 2004 under the study includes CF prototypes i.e. CF agroforestry, CF aqua-agroforestry (for demonstration), CF public woodlots, etc. (Details of CF prototypes are discussed in Section 9.3.1 (3).

Those diversified CF activities would provide immediate, short-term, mid-term and long-term incentives and could be an economical foundation for the user group. Actual subjects to be an incentive for CF activities are listed in the following table.

Structure of Incentives Introduced by Community Forestry by Terms

Immediate	Short-Term	Mid-Term	Long-Term
Land use right	Production from - CF aqua-agroforestry - NFIO - Value added Production	Production from - NFIO - CF agroforestry - Value added production	Production from - CF plantation - CF public woodlot - CF riverside plantation - Value added production
	Fish	Vegetable	Pole
	Prawn	Root crop	Charcoal
	Crab	Legumes	Fruits
	Firewood	Firewood	Multiple function of forest i.e. disaster prevention, land protection, grovel warming, etc.
	NTFP	NTFP	NTFP

Source: JICA Study Team

3.4.3 Training for Participatory Development in Community Forestry

(1) Extension Services of Forest Department

An extension service of the FD is provided by the Forestry Extension Divisions of the Director-General Office led by a staff officer. Depending on FD, the extension division was working for the following extension activities during 1999 to 2002.

- Making documentary videos and films;
- Making video dramas;
- Editing forest related articles for newspapers;
- Publication of forest bulletins;
- Publication of forestry magazines, namely “Sein Yaung Lwin”;
- A quarterly issue of Myanmar Forestry Journal; and
- Showing exhibitions at national events.

In terms of the CF extension activity, handouts and posters for the forest environment and CF were designed and printed under management of the division.

In the field, extension service to the population is mandatory for the township FD office. Among the township FD offices the extension service is charged to the extension staff trained and certified as extension staff about participatory development by CFDTC.

(2) Training on Participatory Development

The Central Forestry Development and Training Center (CFDTC), established in Hmawbi, Yangon Division in 1990 by the support of Japanese grant aid and technical cooperation, is providing training on participatory development. Recently, also, FD set up a sub-center for CFDTC in Mandalay.

In fiscal years 2003 and 2004, the participatory development training course was conducted by CFDTC with the support of JICA six times per year. The two-week CFDTC training course and contents for participatory development is composed of the following two subjects taught in the classroom of CFDTC.

- Participatory Extension System Training Course
- Participatory Extension Method Training Course

The training contents and items of each training course are shown in detail in Table 3.8.

(3) Extension Services and Villagers Expectations

At present (2004), the Laputta and Bogalay Township FD Offices have 7 and 23 forest camps, respectively. The forest camps are utilized as bases for beat officers and for direct forest operations such as the Thar Yar Kone mangrove nursery in the Pyinalan Reserved Forest in the Laputta Township, and the Kadonkani IRM and the Meinmhala Wildlife Sanctuary in the Bogalay Township.

The reserved forest of the study area is divided into seven blocks of beats, and “beat offices”, and “beat officers (in most cases deputy rangers and infrequently foresters)” are posted to each block. The beat office is the smallest management office unit of FD under the township FD office. The beat officer’s mandatory responsibility is for forest management, revenue collection, plantations development, and CF management and support. Therefore, the forest camp/beat office is positioned at the foremost lines of FD to the villagers. The Laputta Township FD Office provides the following organization of the beat office (Figure 3.5).

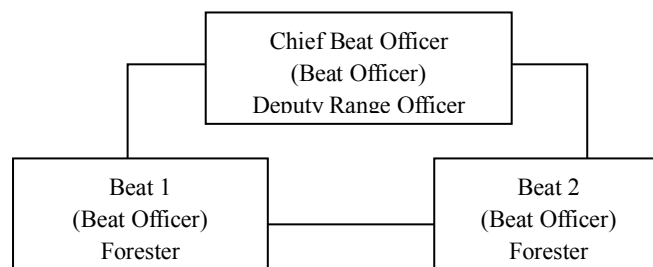


Figure 3.5 Organization and Staffing of Beat Office of Laputta FD Office

3.5 Current Mangrove Forest Management

3.5.1 Application of National Policy, Forest Law, and Regulations

(1) Current Forest Management System in the Study Area

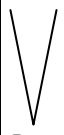
1) Basis of Forest Management

Currently, forest management in the study area is based on the following documented plans.

- Myang Mya District Forest Management Plan (1996/1997 to 2005/2006)
- Pyar Pon District Forest Management Plan (1996/1997 to 2005/2006)

District forest management plans are required to be formulated for each administrative district. Thus, Bogalay's forest management plan is included in the Pyarpon District Forest Management Plan, whereas Laputta's forest management plan is included in the Myaungmya District Forest Management Plan. Based on the target and schedule set in the district management plan, township FD offices prepare a plan of operations covering forest management activities on a forest compartment basis. Actual operations are further divided into sub-compartment levels, but according to the existing forest management system, plans and activities are normally documented at compartment level. Based on the management plan, annual activity plans of the districts are formulated by division/state and district FD offices. Then the annual plans are used as instructions to township FD offices. In the Myanmar forest management system, two types of units, management units and ground units, are recognized. The two units are briefly summarized in the following table.

Management Units of FD

Level	Management Unit	Ground Unit	Remark
	Forest Division	Division/State	Both units tend to match
	District	District	Both units tend to match
	Working Circle	Township	
	Felling Series (Planting Series)	Reserved Forest / Public Protection Forest	
	Cutting Session	Compartment / Coupes	

Note: Management and Ground Units in the same row do not always indicate the same degree of level.

A management unit is based on forestry managerial/operational functions, whereas a ground unit is based on the actual administrative boundaries/legal status as well as on the ground delineation.

2) Forest Management Units in the Study Area

Currently, the following two management units are being introduced in the study area.

a) Working Circles

- a. Special Working Circles (Mangrove Rehabilitation)
- b. Local Supply / Community Forest Working Circles

- c. Plantation Working Circles
- d. Production Working Circles

b) Protected Areas:

- a. Wildlife Sanctuary (ex. Meinmahla reserved forest)

The working circle described in Section 3.2.2 serves as a basic management unit in the study area. Normally, compartments (or sub-compartments) are grouped under working circles and overlapping of working circles may be necessary if the same compartments require different types of treatments. Areas of each working circle and protected areas categorized in the five reserved forests are summarized in the following table.

Areas of Working Circles Categorized in the Study Area

(Unit: ha)

Working Circle	Kyakankwinpauk	Pyinalan	Kadonkani	Meinmahla	Pyindaye	Total
Mangrove Rehabilitation	9,874 (34.4%)	13,432 (30.8%)	21,273 (35.1%)	-	-	44,580 (19.9%)
Local Supply / Community Forest	12,160 (42.3%)	9,723 (22.3%)	32,820 (54.2%)	-	50,587 (65.8%)	105,289 (47.1%)
Plantation	-	-	-	-	21,891 (28.5%)	21,891 (9.8%)
Production	4,959 (17.3%)	16,458 (37.8%)	-	-	-	21,416 (9.6%)
Protected Area System				13,680 (100.0%)		13,680 (6.2%)
Excluded from the Working Circle	1,732 (6.0%)	3,939 (9.1%)	6,459 (10.7%)	-	4,422 (5.8%)	16,551 (7.4%)
Total	28,725 (100.0%)	43,551 (100.0%)	60,552 (100.0%)	13,680 (100.0%)	76,900 (100.0%)	223,408 (100.0%)

Source: Pyar Pon and Myaung Mya District Forest Management Plan (1996-2005), 1998.

3) Current Management/Operation Priority in the Study Area

Ongoing operations by FD in the study area are emphasized in compartments categorized as, special working circle (mangrove rehabilitation working circle) and the protected area (Meinmahla Wildlife Sanctuary).

Currently, the majority of natural forest operations and plantation operations by the FD are concentrated in compartments under the mangrove rehabilitation working circles. Also, compartments under the mangrove rehabilitation circle are the basis for ongoing/proposed Integrated Resource Management (IRM) areas and potential core areas for mangrove rehabilitation/conservation.

The entire Meinmahla Reserved Forest is declared as a wildlife sanctuary under a protected area system for protection and conservation of wildlife and the ecosystem. Management and operation of the wildlife sanctuary is mainly conducted by the Nature and Wildlife Conservation Division under FD.

Based on these circumstances, mangrove rehabilitation under the IMMP should primarily

improve and strengthen the current priority of FD to protect and rehabilitate core areas, and then expand operations to outside of the ongoing core areas.

(2) Ban of Construction of Charcoal Kilns and Production of Charcoal

The ban of charcoal production and destruction of charcoal kilns was orally instructed in 1993 by the chairman of Ayeyawady Division Peace and Development Council, the divisional FD office stopped the cutting of delta forests, particularly mangrove species for charcoal, posts, poles, and fuelwood through a written order in 1994. Based on the instructions, all of the charcoal kilns in Ayeyawady Division were destroyed. Currently charcoal production in Ayeyawady Division requires an application for permission and license from the division Peace and Development Council and the divisional FD Office.

3.5.2 Institutional and Financial System for Mangrove Forest Management

(1) Current Institutional System

Figure 3.6 shows the relationship and hierarchical sequence of mangrove forest management planning and implementation structure adapted by FD.

The organizational structure of FD in carrying its mandate is hierarchical and centralized. Up to February 2002 the mangrove plantation and protection in the study area was directly managed and supervised by the Mangrove National Project Director based in the Director General Office in Yangon. A range officer was assigned at each township FD office as in-charge of the plantation and protection of mangrove forests. The district and township FD offices provided logistical support while the divisional FD provided administrative and management support. Labor force for the operation was hired as workers of FD, particularly for nursery and plantation operations.

The annual budget was directly released from the Director General office to the Mangrove National Project for mangrove protection and rehabilitation. However, a deficit of budget was supplied to the range officers in-charge for fulfillment of the planned activities. Thus range officers had to implement the activities by adjusting budget and activities. If adjustments themselves were not enough for the actual implementation and attaining project targets, FD staff involved in activities, such as paddy trade and nipa sheet manufacturing/trade for securing additional budget.

After the termination of the Mangrove National Project in accordance with completion of the UNDP/FAO HDI III Project in February 2002, ordinary routine operation of FD was applied to the forest management of the reserved forest and the operation is being continued at present as described in Section 3.3.4.

Monitoring and reporting follow the same flow of communication and supervision. Mangrove conservation in the Ayeyawady Delta is a regular function and operation of the township, district, and division levels. This means that the reporting, monitoring, evaluation and budgets follow the hierarchical layer from division to districts, to townships, beat and thence to field camps.

(2) Financial System

The financial system follows a similar hierarchical system of reporting, monitoring, and evaluation based on independent institutional arrangements at the district and township level's responsibility and accountability. However, the Laputta and Bogalay Township FD offices are directly responsible for revenue generation and collection of revenue. The annual budget of the township FD office is supplied by the district FD office through divisional FD office from the Director General Office. The supplied budget is apparently in shortage for fulfillment of the instructed plantations, revenue collection and also salaries for maintaining offices and staff. Based on collected information and estimation by the study team, the deficit of the budget for plantations is normally around 80 % of requirement and around 85 to 90 % of salaries also. Therefore the field staffs serving as the beat officers have to generate the revenue from revenue collection or other sources based on instructions of the staff officer or range officer of the township FD office.

At present, there is no production from plantations by FD direct operations in the study area, because of the designated local supply working circle. FD expected to start production and sales from the operation after fulfillment of the operation in 2006 in accordance with completion of the current 10-year district management plan.

3.5.3 Current Situation of Community Forestry with Mangrove Forest Management

(1) CF Certificated Area in Myanmar

The Planning and Statistics Division (PSD) of FD is engaged in estimation of CF certificated areas at division/state, district and township levels. The following tables show accumulated data on CF certificated areas and the number of CF user groups for the whole country. According to the data for the fiscal year 2000, 15,000 ha of areas has been granted CF certificates and for the fiscal year 2003 43,000 ha is granted CF certificates. During the last three years, from 2001 to 2003, 30,000 ha of new CF area has been certified. The biggest share of CF certificated areas nationally is the Shan State with a growth of share from 15.6% to 58.6%. On the other hand, the Ayeyawady Division reduced its share to 19.4 % of the total.

Up until 2000 it was apparent that FD promoted CFI in collaboration with donors such as

the UNDP-HDI project. During 2000 to 2003, over 20,000 ha of CF area was granted certificates in the Shan State and currently the Shan State occupies 60 % of the whole CF certificated area of the country. This achievement was also supported by the HDI project under UNDP.

The Community Forestry Certified Area (ha)

State/Division	CF Certified Area (ha)									
	Plantation		Reserved Forest		Un-classed forest		Total		Percentage	
	2000	2003	2000	2003	2000	2003	2000	2003	2000	2003
1 Kachin			0	174	0	142	0	316	-	0.7
2 Kayah	0		0	0	100	40	100	40	0.7	0.1
3 Kayin	0		0	0	0	256	0	256	-	0.6
4 Chin	0		40	91	24	97	64	188	0.4	0.4
5 Sagaing	236		0	81	0	362	236	443	1.6	1.0
6 Bago	0		1,079	1031	0	1492	1,079	2,524	7.4	5.8
7 Mandalay	1,156		1,338	2,600	0	988	2,556	3,588	17.5	8.3
8 Magwe	500		394	435	26	798	1,764	1,233	12.1	2.9
9 Mon	0		0	67	0	0	0	67	-	0.2
10 Rakhine	74		0	136	0	517	210	652	1.4	1.5
11 Yangon	0		291	223	0	0	0	223	-	0.5
12 Shan	0		782	6,904	1,505	18,357	2,288	25,261	15.6	58.6
13 Ayeyawady	0		5,661	8,349	0	0	6,329	8,349	43.3	19.4
Total	1,967		9,585	20,090	1,655	23,050	14,626	43,140	100.0	100.0

Source: PSD, Forest Department

Number of CF User Groups and Members

State/Division	No of CF User Groups		No of CF User Group Members	
	2000	2003	2000	2003
1 Kachin	0	5	0	200
2 Kayah	1	1	16	75
3 Kayin		3		51
4 Chin	3	3	75	30
5 Sagaing	19	12	1,061	248
6 Bago	1	8	360	84
7 Mandalay	50	22	8,727	444
8 Magwe	20	127	2,443	9,778
9 Mon		4		59
10 Rakhine	5	46	376	1827
11 Yangon	1	4	0	100
12 Shan	11	136	971	9036
13 Ayeyawady	54	90	3,330	5,211
Total	165	461	17,359	27,143

Source: PSD, Forest Department

(2) CF Certificated Area in the Study Area

The following table summarizes the number of user groups and CF certified areas in the study area. At the year 2000, about 6,400 ha, which equals to 3.7 % of the study area was certified. Both townships had the same number of user groups granted CF certificates (including 10 CF user groups in the Kakayan Reserved Forest in the Laputta Township which is outside the study area). On the other hand, regarding CF certified area, the Laputta Township FD established twice that of Bogalay Township, because of the following different socioeconomic and natural conditions between the reserved forests:

- Population density of the reserved forests in the Bogalay Township is higher than the reserved forest of the Laputta Township.
- Because of low population density, the reserved forests of the Laputta Township have more land available to be allocated for CF.
- Vegetation of mangrove forest remains in the reserved forests of Laputta Township more than the Bogalay Township, so Laputta allocates more mangrove forest areas for CF.

No. of User Groups and CF Area in the Study Area (2000 and 2003)

(unit: ha)

Reserved Forest	No of UsG	No of Members	Avg. UsG members	Plantation Area	NFIO/RIF Area	Total Area	Area/Member
March 2000							
Laputta	37	2,202	51	1,995	2,325	4,320	2.0
Kyakankwinpauk	12	284	24	332	210	542	1.9
Pyinalan	25	1,918	77	1,663	2,115	3,778	2.0
Bogalay	47	1,618	38	1,980	77	2,057	1.3
Kadonkani	18	925	51	608	23	630	0.7
Pyindaye	29	693	24	1,372	54	1,426	2.1
Total	84	3,820	44	3,975	2,402	6,377	1.7
March 2004							
Laputta	39	2,513	53	2,451	2,730	5,181	2.1
Kyakankwinpauk	12	284	24	361.8	230	592	2.1
Pyinalan	27	2,229	83	2,089	2,500	4,589	2.1
Bogalay	17	590	46	1,377	602	1,978	3.4
Kadonkani	10	541	54	664	25	689	1.3
Pyindaye	7	259	37	712	577	1,289	5.0
Total	56	3,103	49	3,828	3,332	7,159	2.7

Source: PSD, Forest Department, 2004 and Myaung Mya District FD Office, November, 2004

Note: in the Kakayan reserved forest, 10 user groups (740 user group members) and in total 1,659 ha of CF area has been granted CF certificated.

The following table describes distribution of CF user group members by type of livelihood.

The CF certificate is granted to all kinds of households existing in the reserved forest.

Distribution of Households of CF User Groups by Type of Livelihood and Reserved Forest (2002)

Type of Livelihood	Kyakankwinpauk (n=1855)	Pyinalan (n=3213)	Kadonkani (n=1499)	Pyindaye (n=2298)	Total (n=9638)
Agriculture	21.6	14.7	33.2	51.8	29.9
Fishery	14.0	19.6	24.2	1.4	13.6
Fish processing	3.5	1.6	3.0	0.3	2.5
Salt Processing	0.1	0.1	-	-	-
Rice Polishing	0.1	0.1	0.1	0.3	0.2
Agri-Processing	-	-	-	-	-
Livestock	-	0.9	-	-	0.3
Small Business	2.3	2.0	2.7	1.8	2.4
Casual Labour	57.1	59.8	36.8	43.2	50.2
Charcoal production	-	-	-	-	-
Forestry	-	-	-	0.6	0.2
Other	1.4	1.3	-	0.5	0.8
Total	100.0	100.0	100.0	100.0	100.0

Source: JICA Study Team, 2002

(3) Current Situation with CF Activities in the Study Area

The current status of the CF implementation is summarized in the table below. The actual implementation areas of the certified CF area as of 2002 are 41 % in Laputta and 38 % in Bogalay respectively. In total, CF activities are actually only carried out in 36 % of the certified CF area. This is mainly due to the rotation of each CF management plan and insufficient forestry technology, shortage of seedling supply from FD and managerial reasons such as land disputes.

Implemented CF Areas in the Study Area (2002)

	Certified CF Area (ha)			Implemented CF Area (ha)		
	Plantation	NFIO/RIF	Total	Plantation	NFIO/RIF	Total
Laputta Township						
Kyakankwinpauk	362 61%	230 39%	592 100%	56 15%	130 57%	186 31%
Pyinalan	1,817 44%	2,311 56%	4,128 100%	828 46%	942 41%	1,770 43%
(Control) Kakayan	1,056 58%	756 42%	1,812 100%	302 29%	155 20%	456 25%
Subtotal	2,179 46%	2,541 54%	4,720 100%	884 41%	1,072 42%	1,956 41%
Bogalay Township						
Kadonkani	664 96%	25 4%	689 100%	246 37%	0 0%	246 37%
Meinmhala	0	0	0	0	0	0
Pyindaye	1,499 96%	59 4%	1,558 100%	526 35%	0 0%	526 35%
Subtotal	2,165 96%	84 4%	2,249 100%	772 36%	0 0%	772 36%
Total	4,344 62%	2,625 38%	6,969 100%	1,656 38%	1,072 41%	2,728 39%

Source: Forest Department, 2002

Meanwhile, NFIO/RIF are carried out by CF user groups outside of the CF certified areas, especially in Bogalay. The major reasons could be the strong intention of the user group to expand the certified areas in future and the high requirement of seedlings for plantation of the certified lands. This activity is neglected by the Forest Law because of trespassing to the reserved forest without permission. In other words, FD has to have more capacity for management and support of CF activities.

(4) Failed CF Activities in the Study Area

The following two tables summarize the failed CF activities that were found to have been turned into paddy and subsequently, returned to FD. Overall 12 % of the total certified areas were turned into paddy with more such CF areas in the Bogalay Township than in the Laputta Township. This happened because of the apparent lack of support and management of FD in collaboration with TPDC and SLRD. Paddy is the most prioritized land use even in the reserved forest as per the principle of Myanmar. Also there is some weakness in selection of CF areas in recognized agricultural areas. Moreover inadequate selection of

tree species for plantation caused failure and compelled CF user groups to return the areas to paddy.

The village profile site survey conducted in the study revealed that there was no CF area turned into paddy in the Kyakankwinpauk Reserved Forest in the Laputta Township but 23 % of the CF area in the Bogalay Township had been changed into paddy. This could be caused by the higher population pressure in the Bogalay Township and also less support to CF user groups by township FD office than in the Laputta Township.

CFI Area Turned into Paddy

RF	CFI area into paddy fields			
	Plantation	NFIO/RIF	Total	%/Certified Area
Laputta TS				
Kyakankwinpauk	0	0	0	0%
Pyinalan	219	23	242	6%
<i>Control (Kakayan)</i>	176	1	178	11%
Subtotal	219	23	242	5%
Bogalay TS				
Kadonkani	0	146	146	21%
Meinmhala	0	0	0	-
Pyindaye	2	378	380	24%
Subtotal	2	524	527	23%
Total	221	547	769	11%

Source: Forest Department 2002, Village Profile Site Survey 2002

In the Pyinalan Reserved Forest, 23 ha of the CF certified area were returned to FD, mainly due to further population pressure and inadequate CF land selection for mangrove species. On the other hand, the Bogalay Township has had no land returned to FD.

CF Area Returned to FD

RF	CFI Area returned to FD			
	Plantation	NFIO/RIF	Total	%/ Certified Area
Laputta TS				
Kyakankwinpauk	0	0	0	0.0%
Pyinalan	14	9	23	0.6%
<i>Control (Kakayan)</i>	88	33	121	7.0%
Subtotal	14	9	24	0.5%
Bogalay TS				
Kadonkani	0	0	0	0.0%
Meinmhala	0	0	0	0.0%
Pyindaye	0	0	0	0.0%
Subtotal	0	0	0	0.0%
Total	14	9	24	0.3%

Source: Forest Department 2002, Village Profile Site Survey 2002

(5) Relationship between Villagers and Mangrove Forest

The villagers' daily life in the study area totally depends on the mangrove forest for extraction of fuel wood, catching fish, crab, shrimp, or shells and processing mangrove products for their daily commodities or for market. Even farmers get part of their earnings by fishing or catching fish or prawn, which may account for a major part of their income.

Human life in the area is closely linked with the mangroves or mangrove based products. The distribution of household producing forest products by reserved forest is given in the following table.

Distribution of Households Producing Forest Products by Reserved Forest

(unit: %)

Forest Product	Kyakankwinpauk (n=1,657)	Pyinalan (n=1,978)	Kadonkani (n=2,728)	Pyindaye (n=3,288)	Total (n=9,651)
Log Processed	1.5	2.5	38.7	6.7	14.0
Log Non-processed	17.0	44.3	61.3	91.6	60.5
Leaf/Branch	68.2	33.4	-	-	18.6
NTFP	-	0.5	-	-	0.1
Fruits	-	-	-	-	-
Others	13.3	19.2	-	0.6	6.4
No answer	-	0.1	-	1.1	0.4
Total	100.0	100.0	100.0	100.0	100.0

Note: (1) NTFP means Non-Timber Forest Products

(2) The other category includes forest product items such as dyes, tannins, medicine, honey.

Source: Village Profile Site Survey 2002, Rural Rapid Appraisal (RRA) 2002

Since the Peace and Development Council of Ayeyawady Division banned the production of charcoal and firewood in 1993, charcoal production had been terminated. However, the villagers have practiced fuelwood and log extraction. Nipa is, at present, a commercial forest product since nipa thatch is widely used for house construction, particularly for making the roofs and walls. Of the individuals who engaged in forestry products in the study area, 97 % are for home use and only 3 % are for commercial purposes.

(6) Constraints on CF

The constraints on CF activity in the study area are carefully analyzed hereunder for future development of sustainable community forestry.

1) Delay of Certification

Because of a deficit in the operational budget, the township FD offices are not able to execute field surveys for sites selected for CF land allocation. The budget deficit of township FD offices may cause delay of certification. It has also been reported that one CF user group did not receive a CF certificate until 3 years after submission of their application due to lack of management and support by FD and also by absence of donor's support.

2) Insufficient Seedling Supply

FD is responsible for supply of necessary seedlings to CF user groups during the first rotational cycle. This duty of FD for seedling supply is explicitly stated in CFI. However, shortages or lack of seedlings for CF user groups are common in the study area. Furthermore, township FD offices understand that transportation of seedlings for the CF activity is a duty of CF user groups instead of FD. From this understanding, CF user groups have to carry seedlings with rowing boats that are the only available carrier for CF user

groups.

The Byone Hmwe mangrove nursery in the Kadonkani Reserved Forest produces 1.3 million seedlings per year in 2002. About 20 % of the production is pot seedlings and the remaining are bare root. Firstly the seedling is supplied to the plantation areas in Integrated Resource Management in Kadonkani, and then surplus seedlings have been supplied to CF user groups. The Kwa Kwa Ka Lay mangrove nursery in Kyakankwinpauk Reserved Forest has a production capacity of 2 million seedlings per year. As of the fiscal year 2002 these are the two centers of seedling production for mangrove management in the study area. However, the seedling production capacity is not enough for mangrove rehabilitation activities under IRM and CF.

3) Inappropriate Forestry Technologies

Although no statistical data related to the survival rate of plantations in the CF area are available, some plantations resulted in a survival rate of 0 % such as Nyaung Ta Pin village in the Pyinalan Reserved Forest, and La Waint Kyun (east) village in the Kadonkani Reserved Forest. In the case of La Waint Kyun (east) village, after three attempts, the villagers turned the certified area into paddy. These failures are caused by a lack of overall capacity of the FD field staffs who are charged to support the CF user group.

4) Misunderstanding of Villagers / FD about CF Activity

According to the result of the RRA, many villagers misunderstood that a shortage of available CF land is a constraint to CF extension activities. This might be due to the current method of applying for CFI for plantation and/or NFIO. However, the definition of CFI as described in Section 3.4.1 (1), can be translated that CFI can apply to various kinds of forestry operations such as CF woodlots, CF plantation, CF compost woodlots, CF agroforestry, CF aqua-agroforestry, etc.

5) Insufficient Incentives for Local People

Current incentives induced by CF for the villagers are not sufficient, because the incentives are only land use rights that will be realized immediately and wood products that appear after at least 5 years later. These long-range incentives do not enable villagers to solve their current problems of poverty.

6) Difficulties related to Daily Livelihood

Since the activities of CF will not produce profit until the first harvest, usually after 5 years from planting, the members of CF user groups have to support their livelihood by their own efforts till then. This makes it difficult for the villagers to participate and/or continue the CF activities.

7) Shortage or Overlap of Working Time

The villagers' peak working season is July to September for rice planting and November to February for its harvesting. The high season for forestry activities overlaps with the agricultural peak season. This is caused by mono cultural agriculture that is practiced in the study area. In summary, the possible constraints mentioned above can be depicted by the following problem tree.

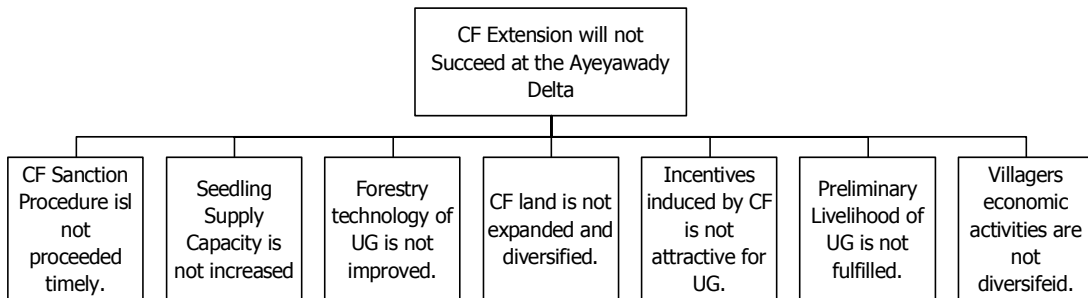


Figure 3.7 Problem Trees of CF Extension

(7) Basic Approach of the Community Forestry Extension

The approaches that break through the obstacles for promotion of the CF extension are as follows:

- 1) The establishment of a close relationship between FD and the CF user group including the activities of preparation of enlightenment programs for villagers and consolidation of user group mutual relationships.
- 2) The CF extension based on a development of demonstration CF user group engaged in sustainable and productive CF activities.
- 3) Capacity development, including the activities of strengthening institutional capability, capacity development of FD staff and the user group, and collaboration with CFDTTC for CF and participatory development training of FD staff.

3.5.4 Review of Kadonkani Reserved Forest Integrated Resource Management

(1) Background: Review Concept, Objectives and Strategies

The FD applied the zoning system for management of protected areas that is the Integrated Resource Management (IRM) in Kadonkani Reserved Forest. The IRM area is subdivided into four different management zones, namely, Protected Reserve Areas (PRORA), Special Management Areas (SMA), Buffer Strips (BS), and Multiple Use Zones (MUZ). The management objectives and strategies of each management zone are described in the following table.

Management Objectives and Strategy by Zones in Kadonkani IRM

IRM Zones	Area (ha)	Management Objectives	Management Strategy
1. Protected Reserve Areas (PRORA)	13,503	Conservation and protection areas for remaining mangrove forest areas	- Utilization of resource is prohibited. - Conservation measures for certain periodic limit and will later be permitted for systematic production of forest products
2. Special Management Area (SMA)	Included in PRORA	Rehabilitation of degraded mangrove forest areas.	- Rehabilitation through regeneration improvement felling and plantation establishment - Relocation of 14 villages which temporarily settle inside the SMA including PRORA and BS
3. Buffer Strips (BS)	Included in PRORA	Buffer between PRORA and MUZ	- Construct firebreaks and establish demarcation boundaries of one furlong (200m) width between PRORA and MUZ. - Prohibited for any resource utilization
4. Multiple Use Zone (MUZ)	8,815	Forest rehabilitation and utilization by communities.	- CF implementation by villages located in MUZ - Reallocation of villages inside PRORA to MUZ

Source: Forest Department (2002)

The IRM in the Kadonkani Reserved Forest is commenced in May, 1997 by delineation of the PRORA boundary. Villages located inside PRORA were reallocated to MUZ areas and the reallocation completed by March 1998. In December 1996, there were 2,708 people in 574 households distributed in 12 temporary villages inside PRORA including SMA and BS areas (In MUZ, there were 12 villages with a total of 5,143 people in 1,044 households). The PRORA has a total land area of 13,503 ha and MUZ has 8,815ha.

The goal of IRM in the Kadonkani Reserved Forest is to build a sustainable environment in the sphere of the regional development plan with active local participation, particularly local organizations and CF user groups. The IRM has the following broad objectives.

- 1) To integrate mangrove conservation with development needs of villagers,
 - 2) To promote public awareness including mangrove protection techniques,
 - 3) To rehabilitate degraded mangrove forests through effective management and community participation,
 - 4) To reforest the denuded mangrove areas and marginal agricultural lands through community wood lots and CF plantations, and
 - 5) To improve the welfare of local communities with provision of environmentally sound income and food production activities in forestry, agriculture, livestock and fishery.
- (2) Assessment of Management Effectiveness of IRM/PAS
- 1) Design Evaluation:

In terms of the design of IRM, the designation of BS with a one furlong (200m) width

around PRORA may not be sufficient and not serve the purpose of 1) barrier to protect mangrove resources inside, and 2) mobilizing villagers to establish a strong social fence to prevent encroachment and illegal cutting.

The current management objective of designating PRORA may not be appropriate and may be inconsistent with the principles of biodiversity and sustainable development. The management objective of PRORA is to conserve and protect mangrove forests and later to be permitted for systematic production of forest products. The opening-up of PRORA for systematic production in the future may be in conflict with biodiversity conservation requirements. The inappropriate categories of buffer strips, area coverage, and boundary definitely pose problems in management. Currently, the existing mangrove forest outside PRORA is open and vulnerable to illegal cutting and conversion to paddy fields. The FD has tolerated cutting and cultivation outside PRORA. Redesigning of the zoning and reformulating of management objectives and strategy should be undertaken.

The outside boundary of MUZ is not clearly defined on the ground, and may also cause conflict with the zone management areas and surrounding areas that are dominated by paddy fields.

2) Inputs Provided

In 1996, the UNDP/FAO produced a land use map to serve as a basis in determining zones of the Kadonkani IRM. After the commencement of IRM, FD was responsible for protection and management of PRORA, and the office for the Mangrove National Project directly provided funds and supervised its implementation. Less attentions and inputs were provided to MUZ by FD. On the other hand, the UNDP/FAO project was involved in the formation of CF user groups and has been providing technical and financial assistance to them since 1998. The UNDP target village tracts surrounding the IRM area, including villages inside of MUZ, are presented in the following table. The UNDP targeted three village tracts inside the Kadonkani Reserved Forest where the primary concern was to support the socioeconomic condition of the people by providing basic needs or services to the communities.

UNDP Project Activities in Kadonkani Reserve Forest as of March 2002

Village Tract Name.	Total No. of Villages	Health (001)	Water and Sanitation (002)	Education (004)	Microfinance (005)	Food Security/ Mangrove (008)	Support Project (010)
1. MAGU	33	28	22	25	15	9	28
2. AYEYAR	20	18	15	13	0	4	18
3. KADONKANI	73	64	58	54	0	22	64
Total	126	110	95	92	15	35	110

Source: UNDP/HDI Report, 2002.

FD has been maintaining Byone Hmwe nursery, one field camp, two guest houses, and equipment for nursery and plantation operations. As of January 2003, FD has assigned 13 regular field staff led by a range officer. Foresters and deputy ranger are manning the guard posts or field stations which are distributed in 9 locations. The field stations are located along riverbanks together with the houses/shanties of casual laborers.

The five year target for reforestation areas was an annual rate of 486 ha (1,200 acre) per year. The target areas are located in compartment Nos. 36, 38, 39, 42, 43, 45, 48, 50, 52, 55, 57, 61, 63, 64, 65 and 68. The five year plan starting the fiscal year 2002 and budget requirements for FD operations in the Kadonkani IRM is summarized in the following table.

Five-Year Plan of IRM in Kadonkani Reserve Forest

	Major Activities	Unit of Measure (ha)	Budget (million kyat)				
			2002	2003	2004	2005	2006
1	Plantation	486	18.0	20.4	22.8	25.2	27.6
2	Pruning Operation	810	4.0	5.0	6.0	7.0	8.0
3	Thinning Operation	810	4.0	5.0	6.0	7.0	8.0
4	Natural Forest Conservation	13,770	6.8	8.5	10.2	11.9	13.6
5	Regeneration Improvement Felling	405	3.0	3.5	4.0	4.5	5.0
6	Community Forestry	405	10.0	12.0	14.0	16.0	18.0
	Total	16,686	45.8	54.4	63.0	71.6	80.2

Source: Forest Department, 2002.

3) Output Derived

Since 1997, FD was able to establish 2,270 ha of mangrove plantations particularly in the SMA area which is included inside PRORA. As shown in Table 3.9, *Avicennia officinalis* is the most common species planted by FD. Most of these areas are located in high ground level areas wherein *A. officinalis* survives but grows slowly compared to its growth when planted in the low to medium ground level areas. *Rhizophora apiculata* was planted in a trial or pilot areas in 1996 - 1997, non-mangrove species were also planted from 1994 - 1998 in high ground and extremely high ground areas. The trend of heavily using *Avicennia officinalis* in rehabilitation of SMA is towards the establishment of pure or homogenous plantations, which may not be in accordance with the recommendation of using mixed, indigenous species for species diversity. In restoring the vegetation cover of SMA for biodiversity purposes, heterogeneous or mixed species of *Avicennia officinalis*, *Excoecaria agallocha*, *Hibiscus tiliaceus*, *Phoenix paludosa*, *Aegialitis rotundifolia*, and *Ceriops decandra* should be used instead of *Avicennia officinalis*.

As summarized in the following table, seedling production in Byone Hmwe nursery also heavily concentrated in production of *Avicennia officinalis* seedlings.

Annual Seedling production of Byone Hmwe Nursery (2003)
(unit: 1,000 seedlings)

Species	Quantity
<i>Sonneratia apetala</i>	30
<i>Avicennia officinalis</i>	1,500
<i>Bruguiera gymnorrhiza</i>	30
<i>Heritiera fomes</i>	4
<i>Ceriops decandra</i>	4
<i>Rhizophora</i>	2
<i>Sonneratia caseolaris</i>	22
Others (<i>Aegiceras</i> & <i>Excoecaria</i>)	8
Total	1,608

Source: Forest Department, 2002.

In the Kadonkani Reserved Forest, FD and the UNDP/FAO project were able to assist villagers to form CF user groups with a total membership of 925 households in 18 villages. These user groups were able to establish 624.2 ha of CF plantation areas and 24.7 ha of regeneration improvement felling (natural forest operation) areas. The detail is shown in Table 3.10.

FD had effectively protected PRORA against encroachment and poaching but conducted less management and activities outside of PRORA, which induced continuous cutting and conversion of mangrove into paddy fields. As of January 2003, the remaining forest stands inside PRORA are, apparently, in their initial period of recovery, and there is no new encroachment and cultivation of paddy fields. The idle and abandoned paddies are now vegetated with grasses and shrubs and are targeted for a 5-year reforestation program at 496 ha annually. However, outside PRORA, cutting of *Phoenix*, *Hibiscus*, *Avicennia* and even *Heritiera fomes* was rampant. Migrants, seeking temporary dwellings within MUZ, caused an unprecedented increase of population and establishment of new villages as recorded by the village tract survey in March 2002.

4) The Process Involved

FD is employing laborers to work in nurseries and in plantations, including maintenance and tending operations at a minimal wage of 500 kyat/day with fringe benefits such as fishing rights, collecting poles, etc. Through engagement with the FD work, the villagers understanding about mangrove forestry has been deepened.

FD commenced IRM in accordance with the permission of Bogalay TPDC on a proposal from FD, because of resettlement of villagers in the plan. Accordingly, the villagers were forced to move out from their cultivated paddies and villages/settlements without any compensation except the seedlings to be supplied after starting CF. According to FD, there were no conflicts on the resettlement. It is obvious that the understanding and participation of TPDC and VPDC are required for implementation of a plan of this nature.

The UNDP/FAO project and FD (the Mangrove National Project) shared roles for implementation of IRM in an approach of the “jointly and separately” concept. Both organizations were involved in IRM related activities, but FD concentrated in forestry operations inside PRORA, and on other hand, the UNDP/FAO concentrated in CF development in MUZ. The UNDP/FAO project had not been supplied equipment or budget for the FD activities. FD fulfilled the roles with budget supplied by the national project that is different from its ordinary current or capital budget. After the termination of the national project in the fiscal year 2002, the Bogalay Township FD Office operates the IRM with the FD capital budget.

5) Outcome evaluation

The objectives of IRM are integrated into broad concepts of conserving the mangrove resources through effective collaboration of villagers and government local authorities, i.e. DPDC, TPDC, VPDC, and FD, to maintain the stability of the mangrove forest ecosystem. Thus it sustains economic and environmental benefits that mangroves can provide, not only for the present generation, but also through the next generation. This is the underlying concept of sustainable development, which is translated into broad objectives of IRM. However, obviously, IRM of Kadonkani failed to demonstrate the applicability of sustainable development of mangrove forest ecosystems through community participation for the following major reasons, 1) poor forest plantation design not implying production, 2) insufficient promotion and support of CF activities by resettled villagers, 3) improper BS management, and 4) insufficient monitoring and evaluation.

(3) Items of Development from Implementation of IRM

1) Development of Adequate Mangrove Forestry Technology

Establishment of mangrove plantations in high ground level areas is less feasible. Though technically it is viable, most of the introduced species (*Avicennia officinalis*, *Sonneratia apetala*, *Excoecaria*, *Aegiceras* and *Ceriops* species) grow slowly and low survival in these areas. However, rehabilitation of the high ground levels with mangrove may provide, not only direct economic benefits, but be substantially extended to productivity and stability of the mangrove forest ecosystem. In order to increase the survival rate of these species, it is recommended that the planting techniques be improved. In the extreme high ground level, introduction of non-mangrove species would be alternatives based on site conditions and plantation objectives.

2) Rehabilitation of mangrove in the low and medium ground levels

This ground level should be given priority, because of majority acreages. The PRORA had patches of open space suitable for enrichment planting, and had some extent of sparse

density vegetation cover at the ground levels. Although, these areas may later on be naturally generated by adjacent mangrove stands, it may take a longer period for natural regeneration to take place, hence, supplementary or enrichment planting in between openings or gaps facilitates the restoration of forest cover.

3) Development Technique to Assisted Natural Regeneration

The technique of assisted natural regeneration is already proven and practiced in mangroves of the Ayeyawady Delta, especially in the Laputta Township. It is strongly suggested that assisted natural regeneration be conducted in the remaining mangrove forests.

4) Integration of Mangrove Technology with Linkage of Natural Conditions

Natural conditions such as soil characteristic, soil fertility, salinity, ground level, etc., of the plantation sites vary. Current IRM plantation relies on the experience of the assigned FD officers and field staff, so the experience should be integrated in writing based on trial, monitoring, and observation activities.

5) Redesign Buffer Strip Management

BD should be broader in scope and extent and be divided into zone strategies. The CF user group settling around PRORA should be organized to serve as a “social fence” against any destructive elements.

6) Establish the IRM projects in the Pyinalan and Kyakankwinpauk Reserved Forests

The lessons learned regarding planning, implementation and monitoring and evaluation of the Kadonkani IRM should be a guiding tool and a refinement in the establishment of IRM in other reserved forests. Thus, FD should commence existing IRM plans in the reserved forests by standardizing existing methods used in the Kadonkani IRM.

3.5.5 Other Relevant Agencies Associated with Mangrove Forest Management in the Study Area

(1) Township Peace and Development Council (TPDC)

This is the township administrative agency and is engaged in a range of activities including the provision of social services as well as the collected revenues on farmed land. In the Bogalay Township, TPDC comprises Branches 1-3 dividing into Groups 1-5 collectively employing 28 main staff. Annual budgets for the periods 1999/2000, 2000/2001, and 2001/2002 were 1.8 million kyat, 6.1 million kyat, and 6.5 million kyat, respectively. On a regular basis once per month, TPDC is convened with the participation of related branches. The committee chairman and secretary are dispatched from the Ministry of Home Affairs.

The TPDC includes an administrative department which is responsible for collected revenues on alcohol and farmlands outside of reserved forest areas. The land taxes are imposed on paddy fields in 9 classifications depending upon paddy varieties. The highest tax on paddy fields accounts for 5 kyat/acre (12.4 kyat/ha). In addition, nipa and homestead gardens are also taxable at a fixed rate of 3 kyat/acre: 7.4 kyat/ha (2 kyat/acre: 4.9 kyats/ha in the case of Laputta Township). An organization chart of the Bogalay TPDC is illustrated in Figure 3.8.

(2) Township Myanma Agriculture Services (MAS)

This agency belongs to the Ministry of Agriculture and Irrigation and is engaged in activities based on instructions from higher offices of MAS and TPDC. MAS in the Laputta Township is responsible for provision of agricultural extension services, mainly for cultivation of monsoon and summer paddy as well as pulses, vegetables, fruits, etc, to farmers living not only in areas outside the reserved forests but also within the forest areas. The services include pest control, introduction of high yield variety paddy, and farmer's training. It owns six offices (Laputta, Bine Daount Chaung, Be Tut, Hlaing Bone, Bay Pauk and Kaka Yan) with a total of 35 personnel comprising one township officer (staff officer), two deputy township managers, 11 village tract managers, 11 assistant village tract managers, and 10 office staff. Annual budgets for the periods 1999/2000 and 2000/01 accounted for 4.21 million kyat and 4.42 million kyat, respectively.

In the Bogalay Township, MAS has deployed 27 agricultural extension staff who are engaged in agricultural extension services targeting farmland outside the reserved forest areas. Seven branch offices have been established under the township office, i.e. at Lin Dine, Hlwa Taung, Tha Kan Wa, Tha Byu Kone, Hay Man, Set Su and Ah Mar which engage in activities targeted improving food production. The agency's service area is primarily within an area of irrigated double cropping of paddy, although problems have been cited in terms of labor shortage during the transplanting and harvesting periods.

(3) Myanma Agricultural Products Trading (MAPT)

This agency specializes in paddy procurement and is located under the Ministry of Commerce. MAPT in Laputta Township deploys a total of 77 personnel comprising one township officer, three managers, 16 office staff, and 57 field workers including 15 persons attached to each of 15 paddy collection centers located through out the township. Annual budgets including paddy purchasing costs for the periods 1999/2000, 2001/02 and 2002/03 were 1,103.5 million kyat, 1,105 million kyat and 1,153.7 million kyat, respectively. Of the 15 paddy collection centers, six centers at Ah Mat, Ka Nyin Kone, Myit Pauk, Yae Daunt, Pyin Htaung Twin and Hlwa Zar are located in the study area with a total purchase volume

of 796,720 baskets (approximately 17,528 tons) in 1998/99.

In the Bogalay Township, MAPT employs a total 43 staff comprising 14 persons in the township office, 29 persons in 10 paddy collection centers consisting of 2 field paddy collection centers, 2 paddy warehouses and 6 rice mills. Besides, 6 rice mills serving as the paddy collection center, MAPT owns 23 rice mills in the whole township. The 10 paddy collection centers have been established that engages in compulsory paddy purchase from farmers throughout the township jurisdiction including reserved forest areas. Annual budgets including paddy purchase costs for the period 1999/2000, 2000/01 and 2001/02 were 1,320.3 million kyat, 1,107.1 million kyat and 1,191.6 million kyat, respectively.

Each farmer is in possession of a "Farmer Book" (where the land size, and the production and yield of paddy are entered) issued by MAPT. After being processed at MAPT owned mills within Laputta and Bogalay Townships, milled rice is directly shipped to rice deficit areas in the country and warehouses in Yangon through the Export Department of MAPT. The totals of such purchased paddy within Bogalay Township in 1999/2000, 2000/01, and 2001/02 were 3.1 million baskets (65,100 tons), 3 million baskets (63,000 tons), and 2.9 million baskets (60,900 tons), respectively.

(4) Township Fishery Department

The Laputta Township Fishery Department Office employs a total of seven staff including one township officer, one deputy township officer, one assistant township officer and four office staff. All fishery grounds are open (there is no leasable area) and are intended to be operated by fishermen who have duly obtained the relevant fishing license. Annual budgets for 1999/2000, 2000/01 and 2001/02 were 225,000 kyat, 738,239 kyat, and 714,000 kyat, respectively.

In the Bogalay Township, six staff comprising one township officer, one deputy township officer, two assistant township officers, and two office staff are permanently assigned to the township Fishery Department office, with an additional staff deployed at the Fishery Training Center and other appurtenant facilities. Annual budgets for the periods 1999/2000 and 2000/01 were 145,000 kyat and 382,000 kyat, respectively. Fishery grounds in the Bogalay Township comprise both open and leasable grounds. In the case of the former, these are operated by fishermen who have duly obtained a license issued by the Fishery Department. In the case of the latter, fishermen pay a fee to a contractor who has successfully bid for the fishing ground rights.

The primary duties of the township Fishery Department offices include: 1) authorizing licensed fisheries and issuing the relevant licenses, 2) survey of volume of marine products handled at Bogalay harbor, 3) setting of benchmark prices for marine products, 4)

promoting freshwater fish farming, and 5) providing technical guidance at the Fishery Training Center (in Bogalay).

The Fishery Training Center within the Bogalay Township run by the Fishery Department is one of three of its kind in the nation. The center in question is located in Kadonkani, and provides instruction to fishermen in the use and repair of fishing gear, as well as fish farming techniques. Responsibility for center operation and administration has been delegated by the headquarters of the Fishery Department in the Ministry of Livestock and Fishery in Yangon.

CHAPTER 4 PRESENT CONDITION OF NATURE AND RESOURCE OF THE STUDY AREA

4.1 Conditions of Mangrove Forests

4.1.1 Historical Review of Mangrove Forests

The mangrove forest in the Ayeyawady Delta had been subjected to commercial logging, particularly for fuelwood, since the late 1800's. The establishment of mangrove forests as reserved forests in the delta began in 1895 and was completed by 1904. The five reserved forests included in the study area were established by 1901.

Established Year of Reserve Forest

Township	RF	Established Year	Remark
Laputta	Kyakankwinpauk	1901	
	Pyinalan	1900	
Bogalay	Kadonkani	1900	
	Meinmahla	1895	Declared as wildlife sanctuary in 1994
	Pyindaye	1900	

Source: Pyar Pon and Myaung Mya District Forest Management Plans (1996-2005), 1998.

The reserved forests were designated for timber, fuelwood, and charcoal production by FD. The reserved forests were divided into compartments as a basis for logging operations, control systems and cutting series. During the early 1900's the reserved forests of the study area were prescribed as a fuelwood working circle and species such as *Bruguiera* were harvested with a certain girth limit.

In 1924, the first 10 year working plan was formulated for scientific management of delta reserved forests under the Delta Forest Division, which somewhat corresponds to the current administrative Myaung Mya, Maubi, Pyar Pon districts. The five reserved forests in the study area and other four reserved forests (i.e. Kakayan, Labutkwe, Kalayaik, Nyinaung Reserved Forests) were formed under the delta working circle, which aimed mainly at the production of *Heritiera fomes* fuelwood and construction timber, and also other species including minor products.

In 1924, 253,215ha (625,222 acres) of mangrove forests were classified under the delta working circle. Of such 60-70% were *Heritiera* dominated stands, 10 % was a *Ceriops* dominated stand, and 10 % was *Cynometra* dominated stands. Blanks, sandy areas, and grasslands were estimated to be less than 10 % of the total reserved forest area under the delta working circle and the majority of the area was classified as mangrove forest. A stand stock table of the first working plan revealed that stock of *Heritiera* trees was 94 trees per hectare (38 trees per acre) for 30.5 to 213.5cm (1 to 7 feet) girth classes. During that time, a minimum exploitable girth was 122 cm (4 feet) and there was a stock of about 24.7 trees per

hectare (10 trees per acre) for girth class 122 cm (4 feet) and over. Though there was regular annual harvesting from the reserved forests, the mangrove forests were well maintained.

Over exploitation of the mangrove forests in the delta working circle started in 1942 during World War II, for increasing demand for timber and fuelwood for military uses. After World War II, exploitation of the mangrove forests gradually increased.

In 1954, the mangrove forest in the delta working circle decreased to 234,692 ha (579,489 acres) from the previous 253,215ha (625,222 acres) and a conversion to paddy fields had occurred. However, the mangrove forests were somewhat well stocked up to the end of the 1950s.

The degradation of mangrove forests increased after the 1960s, by further exploitation of mangrove woods and conversion of mangrove areas to paddy fields and other land uses. Also, suspension of the systematic forest operation management system under the forest division working plan in 1970 accelerated the degradation of the mangrove forests. In 1984, the mangrove forests in the delta working circle decreased to 181,065 ha (447,073 acres).

The Socialist Republic of Burma re-established control of the operation and management systems of reserved forests by adapting the concession system of harvesting forest products. However, during the 1980s and early 1990s overexploitation and fast dwindling of forest resources continued in the delta. The delta forest had been subjected to continuous large-scale commercial cutting up to 1992. But even after the ban for charcoal production and commercial logging in 1993 (Section 3.5.1 (2)), the reserved forests were still subjected to cutting, both for domestic use and for commercial purposes.

As of 2004, FD sets targets and collects permission fees and removal fees for phoenix poles and nipa products in the study area, but the FD has stopped collecting the removal fee for charcoal in the study area since charcoal was banned for production in the delta .

4.1.2 Current Situation of Mangrove Forests

The study team conducted a vegetation transect survey during September to October 2002 to collect data for estimation of species composition and stock volumes of mangrove forests in the study area. The vegetation survey was conducted by setting transect lines in various locations of remaining mangrove forests, forest plantations, and barren lands within Kadonkani, Meinmahla, Pyinalan and Kyakankwinpauk Reserved Forests. In Laputta, 17 transect lines with a total of 126 plots and 12 plantation plots, and in Bogalay 27 transect lines with a total of 68 plots and 20 plantation plots were established. Based on the results of the survey, the following items are analyzed; 1) species composition, dominance, and density, 2) growth structure, 3) stand stock, 4) land gradient and species distribution. The summary of the vegetation transect survey is discussed below and the

details of the survey will be compiled in the volume V: Data Book of the final report.

(1) Species Composition and Distribution

There were at least 48 species of mangrove trees, creepers, shrubs and vines recorded during the vegetation transect survey in reserved forests of Bogalay and Laputta Townships. The species recorded are listed at Table 4.1.

The overall dominant mangrove species in terms of Importance Value, Index of Dominance and Diversity Index were *Avicennia officinalis*, *Bruguiera gymnorrhiza*, *Ceriops decandra*, *Heritiera fomes*, *Brownlowia tersa*, *Sonneratia caseolaris*, *Rhizophora apiculata*, and *Phoenix paludosa*. These species largely influence the vegetation structure of mangroves in different ground levels or gradients.

Brownlowia tersa, *Sonneratia caseolaris*, *Avicennia officinalis* and *Rhizophora apiculata* largely dominated the low ground area. In the middle ground level, *Ceriops decandra*, *Excoecaria agallocha*, and *Heritiera fomes* are the top dominant mangrove species followed by *Aegilitis rotundifolia*, *Xylocarpus granatum* and *Amoora cucullata*. In the high ground level, *Phoenix paludosa* is the most dominant species followed by *Hibiscus tiliaceus*, *Clerodendrum inerme*, *Diospyros embryopteres*. *Phoenix paludosa* is the most dominant and most important species in the high ground gradient, which largely controls and strongly affects the survival, growth and sustenance of any other mangrove species such as *Ceriops decandra*, *Cynometra ramiflora*, *Amoora cucullata*, *Excoecaria agallocha* and *Heritiera fomes*. Although these species preferably grow in the middle ground level particularly towards the high ground, they are also frequently recorded in the high ground level mixed with the *Phoenix paludosa* stands. Vines, creepers, shrubs and grasses, which are classified as dry land or grassland species such as *Caesalpinia cristae*, *Dalbergia spinosa*, *Pluchea indica*, *Clerodendrum inerme*, *Merope angulata*, *Finlaysonia maritima*, *Flagellaria indica*, Myet Ngah (grass species: local name). *Acanthus ilicifolius* and *Acrostichum aureum*, etc. are frequently recorded in the logged-over and open areas, which were previously vegetated by *Phoenix paludosa*.

The importance value of mangrove species is noticeably decreasing towards the higher ground level because fewer tree species and decreasing basal areas are recorded. Mangrove tree species with large dimensions are mostly observed in low ground areas and become scarce and are of smaller size towards the extremely high ground areas. Large size mangrove tree species are fewer in high ground areas than in the middle ground areas because the high ground areas are seldom reached by brackish water. Also, creepers, grasses and vines tend to cover most of the area in the high ground levels.

(2) The Growth Structure

The mangrove forests in the study area can be generally classified as secondary growth in the reproduction or regeneration stage which is mostly composed of pole size trees of dominant mangrove tree species preferably growing in low to middle ground level. The growth structure of the surveyed plots is summarized in the following table.

Growth Structure of Surveyed Plots

Survey Item	Laputta (n = 131 plots)	Bogalay (n = 68 plots)
Average Stand Volume (m ³ /ha)	49.676	30.447
Average Stocking (trees/ha)	5,616	2,783
Stand wood volume (# of plots)		
1. <25 m ³ /ha	87 (69.0 %)	36 (52.9%)
2. 25-75 m ³ /ha	33 (26.2%)	26 (38.2%)
3. 75-150 m ³ /ha	5 (4.0%)	6 (8.9%)
4. >150 m ³ /ha	1 (0.8%)	0
Stocking (# of plots)		
1. adequate stock (>1,600 trees/ha)	110 (87.3%)	58 (85.3%)
2. inadequate stock (1,000-1600 trees/ha)	10 (7.9%)	5 (7.4%)
3. degraded area (400-1,000 trees/ha)	3 (2.4%)	3 (4.4%)
4. opened/denuded area (<400 trees/ha)	3 (2.4%)	2 (2.9%)

Source: Japan International Cooperation Agency (JICA) Study Team (2002)

Based on the vegetation transect survey, it is estimated that reserved forests of both townships had similar proportions of plots in terms of stand volume and stocking class, though plots in Laputta Township had higher values of mean stand volume and stocking class. To estimate the stand volume of existing forests in the study area, mean stand volume and stocking were calculated according to the stocking class as shown in the following table.

Mean Stand Volume and Stocking based on Stocking Class

	Stocking Class	Stand Volume (m ³ /ha)	Stocking (trees/ha)	Remarks
Laputta	Adequate Stock	26.19	9,865	Closed Forest(CM1- 3)
	Inadequate Stock	11.43	1,385	Sparse Forest (SM1-3)
	Denuded Areas	4.41	608	
	Open/Degraded Areas	1.30	369	
Bogalay	Adequate Stock	34.93	3,760	Closed Forest(CM1- 3)
	Inadequate Stock	16.48	1,399	Sparse Forest (SM1-3)
	Denuded Areas	2.37	526	
	Open/Degraded Areas	6.06	250	
Average	Adequate Stock	30.56	6,812	Closed Forest(CM1- 3)
	Inadequate Stock	13.95	1,392	Sparse Forest (SM1-3)
	Denuded Areas	3.39	567	
	Open/Degraded Areas	3.68	310	
Average stocking			2,270	

Note: Refer to Table 2.13 for the definition of CM1-3 and SM1-3.

Source: JICA Study Team (2002).

For convenience, the stocking classes of “adequate stock (>1,600 trees/ha)” and “inadequate stock (1,000-1600 trees/ha)” are considered as forest type - closed forest (codes, CM1 to CM3 in aerial photo interpretation keys), and sparse forest (codes, SM-1 to SM-3 in aerial photo interpretation keys), respectively. As indicated below, the estimated total stand volume for the forests in the study area is approximately 2.2 million m³ and weighted stand volume per hectare is 26.85 m³/ha.

Estimated Total Stand Volume and Stand Volume for Forests in the Study Area

Forest Type	Area (ha)	Unit Volume (m ³ /ha)	Total Volume (m ³)	Weighted Stand Volume (m ³ /ha)
Closed Forest (CM1-3)	55,461	30.56	1,694,888.16	26.85
Sparse Forest (SM1-3)	34,927	13.95	487,231.65	
Total	90,388		2,182,119.81	

Note: Refer to Table 2.1.3 for the definition of CM1-3 and SM1-3.

Source: JICA Study Team (2002)

In the study area, the National Forestry Survey and Inventory of Myanmar was conducted in the fiscal year 1983, and a special survey and inventory was conducted for the Laputta Township in the fiscal year 1991. The previous inventory revealed that an average stock volume of 32.89m³/ha (469.14 stack wood cu.ft/acre) in Laputta and Bogalay townships as of 1984, and an average stock volume of 2.62m³/ha in the Laputta Township as of 1992. Inventory criteria were different among the three inventories, so it is difficult to compare the three stand volumes. However, it can be speculated that the current stand volume of commercial and valuable mangrove species are somewhat decreasing or at least maintaining the stand volume level of 1991, since the stand volume calculated under the study includes all of the species from the spaling stage and has higher stand volume than that of 1991.

The study team also surveyed forest plantations of species with different plantation ages and sites as indicated in Table 4.2. For all species, accumulation of volume seems to be heavily influenced by site conditions, particularly of ground level and frequency of tidal inundation compared to plantation ages. For example, the growth structure of *Avicennia officinalis* plantations, normally planted at a density of 3,000 seedling/ha (1200 seedling/acre) in the study area, is summarized in the following table. The *Avicennia* plantations accumulated wood volume differently in different sites regardless of their age: A 7-year old (1995) plantation as of 2002 in forest compartment 20 of the Kyakankwinpauk Reserved Forest had a stand volume ranging 6.13 to 8.95m³/ha, whereas a 5-year old (1997) plantation as of 2002 in forest compartment 76 of the Pyinalan Reserved Forest had a higher stand volume of 10.06m³/ha. Moreover, a 4-year old (1998) plantation as of 2002 in forest compartment 36 of the Kadonkani Reserved Forest had a stand volume of 23.60m³/ha. The 4 year old *Avicennia* plantation was established in medium ground level

which is considered to be optimum ground level for *Acivennia*, whereas other *Avicennia* plantations were located on somewhat higher ground level areas. Stand stock also varied among plantation sites. This may be derived from the following factors: 1) multi-stem trees, natural regenerated seedlings and/or coppicing were also counted as individuals in the inventory, 2) patching and additional planting were conducted in some plantation sites, and 3) some plantations had higher planting density than 3,000 seedling/ha.

Stand Volume of *Avicennia officinalis* Plantations in Study Area

Established Year	Stand Volume (m ³ /ha)	Stand Stock (#/ha)	Reserved Forest	Compartment
1992	20.90	2,800	Kadonkani	48
1993	33.15	3,625	Kadonkani	47
1994	18.31	1,088	Kadonkani	47
1994	19.85	2,238	Kadonkani	47
1995	8.95	4,714	Kyakankwinpauk	20
1995	8.31	7,071	Kyakankwinpauk	20
1995	8.02	7,214	Kyakankwinpauk	20
1995	6.13	5,347	Kyakankwinpauk	20
1997	10.06	8,900	Pyinalan	76
1998	9.64	19,200	Pyinalan	71
1998	7.30	7,800	Kadonkani	36
1998	23.60	4,900	Kadonkani	36

Source: JICA Study Team

(3) Stand and Stock Assessment

Stand volume and stocking were also analyzed according to diameter class and the result is summarized in the following table.

Stand Volume and Stocking by Diameter Class

Item	Bogalay		Laputta	
	Stand Volume	Stocking	Stand Volume	Stocking
Percentage by diameter class				
1. 5 cm (2.5 -7.5)	66.87%	80.48%	95.28%	97.54%
2. 10 cm (7.5-12.5)	25.48%	14.56%	4.20%	2.23%
3. 15 cm (12.5 -17.5)	5.65%	3.45%	0.31%	0.15%
4. Other classes	2.00%	1.51%	0.21%	0.08%
Top 10 species contributing to stand volume	<i>Rhizophora apiculata</i> <i>Heritiera fomes</i> <i>Bruguiera gymnorrhiza</i> <i>Brownlania tersa</i> <i>Bruguiera sexangula</i> <i>Xylocarpus granatum</i> <i>Avicennia officinalis</i> <i>Kandelia candle</i> <i>Sonneratia caseolaris</i> <i>Phoenix paludosa</i>		<i>Ceriops decandra</i> <i>Rhizophora apiculata</i> <i>Bruguiera gymnorrhiza</i> <i>Heritiera fomes</i> <i>Phoenix paludosa</i> <i>Brownlania tersa</i> <i>Hibiscus tiliaceus</i> <i>Excoecaria agallocha</i> <i>Bruguiera sexangula</i> <i>Avicennia officinalis</i>	

Source: JICA Study Team

More than 90% of individuals, in terms of both volume and stocking, recorded in the survey had a diameter smaller than 12.5 cm, and the majority of such recorded individuals were smaller than 7.5 cm in diameter. Only very few individuals of *Avicennia* and *Sonneratia* were recorded in diameter classes above 15 cm which are classified as timber size trees. In general, mangrove forests of the study area can be characterized as in the recovery/regeneration stage, due to abundance and dominance of small diameter-class trees.

(4) Land Gradient and Species Distribution

The results of the vegetation transect survey give some indications of land gradient category by using species' ecological parameters, since surveyed plots were not strictly identified and classified in accordance with land gradient or tidal inundation class. However, based on the vegetation transect survey, field reconnaissance, and literature review, the relationship of land gradient and species distribution in the study area can generally be described as follows.

Mangrove in the Ayeyawady Delta thrives well in an alluvial substrate where a mixture of fresh and seawater occurs and extending up to the land which is influenced by brackish water level. Thus the existence of mangrove is directly affected by the frequency of tidal inundation, salinity, soil type and land gradients. The mangrove areas in the Ayeyawady Delta are classified in terms of topography including tide level or frequency of tidal inundation such as low ground, medium ground, and high ground. The low ground is inundated by brackish water at least 20 days per month while the medium ground is tidally inundated every spring tide at least 7 days per month. The high ground is inundated during the highest tide at least one day per month while the extremely high ground areas are not tidally inundated and only flooded by rain water during the rainy season.

The ground level, tide level, frequency of tidal inundation and species pattern of distribution under natural conditions will serve as a guide in species/site matching for selection of preferred or desired mangrove species suitable to site conditions for establishment of mangrove plantations and implementation of various natural forest operations. Based on findings and suggestions of Kogo (1993) and field observations by the study team, the ground level classification in the study area can be summarized as follows.

Frequency of Tidal Inundation in Ayeyawady Delta

Mangrove land area class	Tide level (m) above sea level/ Admiralty datum	No. of days of tidal inundation per month during dry season	Tidal inundation class based on Watson Classification	Frequency of tidal inundation per month based on Watson Classification
Low Ground Level 1	0.1-1.7	all high tides (at least 20 days/month)	1	56-62
Low Ground Level 2	1.7-2.0	every medium high tide/every start of spring tides (10-19 days /month)	2	45-59
Medium Ground Level 1	2.0-2.3	every normal high tide/mid spring tides (3-9 days/month)	3	20-45
Medium Ground Level 2	2.3-2.6	every spring high tide (at least 2 days/month)	4	2-20
High Ground Level	2.6-2.7	4 times in dry season by equinoctial/ abnormal high tides	5	0-2
Extremely High Ground Level	2.7-3.3	only flooded by rain water during rainy season	6	none

Source: modified from Kogo, 1993

The species distribution of some important mangrove species has distinct patterns or zones as influenced by land ground level which determines the frequency of tidal inundation and soil type. Results of the vegetation analysis of mangroves in the study area show that the most common mangrove species form pure stands and in each ground level type. Dominant species distinctly exist. The mangrove species distribution based on ground level is summarized in the table below.

Mangrove Species Distribution by Ground Level Classification in Ayeyawady Delta

Ground Level Class	Common Mangrove Species	
Low Ground Level 1	<u>High saline water</u> <i>Avicennia alba</i> (Aa) <i>Avicennia marina</i> (Am) <i>Kandelia candel</i> (Kc) <i>Sonneratia apaetala</i> (Sa) <i>Aegiceras corniculatum</i> (Ac)	<u>Low saline water</u> <i>Kandelia candel</i> (Kc) <i>Nypa fruticans</i> (Nf) <i>Rhizophora apiculata</i> (Ra) <i>Sonneratia caseolaris</i> (Sc) <i>Avicennia officinalis</i> (Ao)
Low Ground Level 2	<i>Nypa fruticans</i> (Nf) <i>Rhizophora apiculata</i> (Ra) <i>Sonneratia qrifithi</i> (sg) <i>Sonneratia alba</i> (Sal) <i>Ceriops decandra</i> (Cd) <i>Bruguiera gymnorrhiza</i> (Bg) <i>Bruguiera sexangula</i> (Bs) <i>Avicennia officinalis</i> (Ao) <i>Aegiceras corniculatum</i> (Ac)	<i>Brownlania tersa</i> (Bt) <i>Ceriops decandra</i> (Cd) <i>Bruguiera gymnorrhiza</i> (Bg) <i>Aegiceras corniculatum</i> (Ac) <i>Heritiera fomes</i> (Hf) <i>Rhizophora apiculata</i> (Ra)
Medium Ground Level 1	<i>Ceriops decandra</i> (Cd), <i>Bruguiera spp</i> (Bsp), <i>Heritiera fomes</i> (Hf) <i>Amoora cucullata</i> (Amcu), <i>Xylocarpus granatum</i> (Xg) <i>Xylocarpus mollucensis</i> (Xm), <i>Aegilitis rotundifolia</i> (Ar)	
Medium Ground Level 2	<i>Heritiera fomes</i> , <i>Xylocarpus mollucensis</i> , <i>Xylocarpus granatum</i> <i>Excoecaria agallocha</i> , <i>Amoora cucullata</i> , <i>Phoenix paludosa</i>	
High Ground Level	<i>Phoenix paludosa</i> , <i>Cynometra ramiflora</i> , <i>Hibiscus tiliaceus</i> <i>Chelodendrum inerme</i> , <i>Myet-kha grass</i> (Mn)	

Source: JICA Study Team

4.1.3 Usage of Mangrove Resources

The study area possesses many aspects in terms of mangrove resources. Mainly the resource is utilized in forms of 1) land development particularly for agriculture, 2) fishery products, and 3) forest products. The major usage of forest products in the study area is summarized below.

(1) Wood Products

Of the available mangrove resource, wood products, in forms of 1) timber, 2) pole and post, 3) fuelwood, and 4) charcoal, are heavily harvested and used by communities inside and outside of the reserved forests. Local communities heavily rely on wood for housing, general construction, heating and cooking, and such demands are increasing yearly due to population growth in and around the study area. Since there are no significant forests and woodlots outside of the reserved forests, the study area is virtually serving as a supply center for wood products for local residents and sometimes for Yangon and other city areas.

Wood Products from the Study Area

Products	Species	Description/ Usage	Remarks
Timber	Trees above 15 cm DBH are classified as timber size and can be sawn into lumber.		
	<i>Heritiera fomes</i>	Wood is durable and has good tension strength to sustain heavy load.	Heavily logged in the first half of the 20th century. Current stocks are not more than pole size.
	<i>Cynometra ramiflora</i>		
	<i>Avicennia officinalis</i>	Fast growing and moderate quality for timber.	Substitute of <i>H. fomes</i> and <i>C. ramiflora</i> , but soft and less durable.
	Non-mangrove Species	Albiza lebbek, Eucalyptus, Acacia, etc.	Utilized when timber size trees are available.
Pole and Post	Definition (size) of poles and posts varies among regions and users.		
	<i>Avicennia officinalis</i>	For general construction	-
	<i>Ceriops decandra</i>	For general construction	-
	<i>Phoenix paludosa</i>	For general construction. Commonly used but less durable	Revenue is charged for phoenix poles and collected by FD
	<i>Heritiera fomes</i>	For general construction	-
	<i>Cynometra ramiflora</i>	For general construction	Good quality but rarely found and used
	<i>Xlyocarpus spp</i>		
Others	For general construction	Whatever available species are utilized (<i>Amoora</i> , <i>Bruguiera spp.</i> , <i>Rhizophora spp.</i> , etc.)	
Fuelwood	For cooking and heating. Stumps and roots are also used for fuelwood.		
	<i>Ceriops decandra</i>		Regularly collected and used.
	<i>Hibiscus tiliaceous</i>	Tree species normally found in high ground areas	-
	<i>Browlania tersa</i>	Shrub species normally found in dense thickets	Less favored but sometimes utilized by the FD workers and others.
	Others	Whatever available species are utilized (<i>Avicennia</i> , <i>Bruguiera spp</i> , <i>Rhizophora spp</i> , etc.)	-
Charcoal	In the Ayeyawady Divison, charcoal production from natural forest has been banned since 1994. However, there are still high demands of charcoal for cooking.		
	<i>Rhizophora spp.</i>	Traditionally favored for charcoal production because of their hardness	
	<i>Bruguiera spp.</i>		
	<i>Heritiera fomes</i>		
	<i>Cynometra ramiflora</i>		
	<i>Ceripos decandra</i>		
	<i>Excoecaria agallocha</i>	Used for charcoal due to their availability.	Regardless of the ban, charcoal of these species is produced and sold in markets.
<i>Avicennia officinalis</i>			

Source: Based on field interviews and field survey by JICA Study Team

Though, there is a high demand for wood products from the study area, most products are illegally harvested under present situations. Statistics on illegal harvesting is not available. However, without systematic tending, harvesting, utilization and control of mangrove resources there would be continuous risk of further degradation from illegal harvesting.

(2) Non Timber Forest Products

Most non-timber forest products from mangrove forests in the study area have less demand from local communities compared to the wood products. However, some non-timber forest products are collected and utilized for both domestic and commercial purposes. The

following table summarizes major non-timber forest products utilized in the study area.

Major Non Timber Forest Products from the Study Area

Products	Species	Description/Usage	Remarks
Nipa			
	<i>Nypa fruticans</i>	Nipa thatch: leaves (fronds) are thatched for roof and wall material.	Produced for both domestic uses and commercial uses.
		Fishing gear: nipa leaf petioles are used as floats, fish poles and the leaflet midribs soaked and twisted as ropes.	
		Food: young seeds (gelatinous endosperm) are eaten raw or preserved in syrup	
		Food: nipa sap collected from flowers is a source of sugar, vinegar, alcohol and fermented beverages.	Cottage industry has already developed in coastal mangrove areas in Taninthary Division
Honey			
	<i>Aegialitis rotundifolia,</i>	The species are favored by honey bees (<i>Apis florea</i> and <i>Apis dorsata</i>).	In a small scale, honeybees are cultured for honey production
	<i>Aegiceras corniculatum,</i>		
	<i>Avicennia marina,</i>	Normally honey is collected from natural beehives.	
	<i>Ceriops decandra,</i>	Honey is used for food and medicine.	
	<i>Excoecaria agallocha,</i>		
	<i>Rhizophora mucronata,</i>		
<i>Sonneratia caseolaris</i>			
Woven stuff			
	<i>Pandanus foeticides</i>	Pandanus leaves woven for mats, hats, fans, bags, etc.	Mainly for domestic use, some are produced for selling.
Medicine			
	<i>Acanthus ilicifolius</i>	- extracts are used for curing common cold. - stems and roots are dried and powdered to be used for face cleansing.	
	<i>Ceriops decandra</i>	Boiled water with bark is used for cleaning wounds and curing digestive disorders	
	<i>Hibiscus tiliaceus</i>	Fresh flowers boiled in pure milk is useful as ear-drops for treatment of ear disease.	
	<i>Rhizophora apiculata</i>	Barks are being used for healing wounds, curing dysentery and its boiled water can also be used to cure stomach disorders.	
	<i>Xylocarpus granatum</i>	Seed is used for diarrhea and related diseases.	
	<i>Xylocarpus moluccensis</i>	Boiled water with bark is used for healing cuts and wounds	
	Others	Fruits, flowers and shoots <i>Aegiceras</i> , and <i>Lumnitzera</i> . <i>Sonneratia</i> have medicinal uses for coughs and drink.	
Tannin extract			
	<i>Bruguiera gymnorrhiza</i>	Barks and woods contain tannin. Tannin is used for dyeing and preserving of cotton fishing nets and leather products.	Currently, uses are limited for leather preservation because fishing nets are replaced with nylon nets.
	<i>Ceriops decandra</i>		

Source: Based on field interviews and field survey by JICA Study Team

Compared to other non-timber forest products, nipa thatches are produced widely throughout the study area. Especially, a commercial production of nipa thatch is common in

Bogalay Township and annual production ranges around 15 - 20 million fronds. Because of large-scale production, the nipa thatch and phoenix poles are currently the only two forest products in the study area, levied by FD. Other non timber forest products are rather small-scale production and more concentrated to domestic uses.

(3) Constraints on Mangrove Forest Product Uses

In the study area, forest products form one of the foundations for livelihood of local communities. However, the following table shows constraints exist for their usage.

The Constraints on Mangrove Forest Product Uses

- | |
|---|
| <ol style="list-style-type: none">1) Not enough inventories to understand the existing available resources.2) Forest products are destructively and/or inefficiently harvested because most of the operations are conducted illegally.3) The actual production amounts are not certain because they are mostly harvested and processed illegally.4) There is not sufficient natural resource management by FD.5) Harvesting and use rights of forest products by villagers are rather limited.6) Existence of such resources and limited control and management over such resources induces further encroachment and illegal harvesting.7) Harvesting and processing methods are rather extensive, and values of products are quite low, compared to demands for such products. |
|---|

Upgrading the constraint on mangrove forest product uses is considered as one of the pathways to rehabilitate mangrove forests in the study area. The following approaches should be considered for preparation of mangrove forest management plans.

- Promote community forestry (CF) activities for reducing illegal harvesting and improving resource management,
- Officialize harvesting and processing by means of the CF activities,
- Improve resource harvesting/utilization efficiency with technical support from FD, and
- Introduce harvesting/processing methods to increase the values of forest products.

4.1.4 On-going Operations related to Mangrove Forests

(1) Regular Operations of Township Forest Department Offices

The regular operation of the township FD offices in the study area can be generalized as follows. For a convenience, forestry operations involved in direct implementation of plantation and natural forest are categorized as “direct operations” and other operations as “indirect operations”. Of such operations, 1) revenue collection from forest products and 2) plantation operation (including seedling production) are the two major and prioritized operations for the township FD offices.

Operations of the Township FD Office

Indirect Operations	Direct Operation
- General Administration	- Plantation (Artificial Regeneration)
- Revenue Collection	- Natural Forest Operation (Natural Regeneration, Weeding, Thinning)
- Action for Forest Law Case	- Forest Protection (Fire Control, Pest and Disease Control, Patrolling)
- Control of Reserved Forest and Compartment Boundaries	- Nursery Operation (Seedling Production)
- The CF Extension and Support	- Forest Road Preparation

Source: Information from Laputta and Bogalaly Township FD Offices

In the following clause, the FD direct operations which are highly relevant for the mangrove forest management in the study area are described.

(2) FD Direct Operations

1) Plantation

The 4th working plan (1957 - 1970) of the Delta Forest Division revealed that since 1923 reforestation operations have been undertaken in different compartments in the delta working circle reserved forests, especially in the Kyakankwinpauk Reserved Forest. The extent of the FD mangrove plantation in the study area from 1980 to 2004 by township is summarized in Table 4.3.

The total extent of mangrove reforestation between the fiscal years 1980 to 2003 was 13,718 ha, of which Bogalay and Laputta had 5,632 and 8,086 ha, respectively. It seems that FD has set its target of annual mangrove reforestation since 1996 with the approval of the 10-year Management Plan (1996-2006) and with the creation and funding of the National Mangrove Project which paved the way for the establishment of IRM in the Kadonkani Reserved Forest. The annual plantation target area after 1996 ranged 405-486 ha (1,000 -1,200 acres) in Bogalay and 527 -648 ha (1,300 -1,500 acres) in Laputta.

The annual schedule of the FD plantation activities is presented in Table 4.4. Normally, the planting season is June and July that corresponds to the beginning of the rainy season. However, the actual planting time varies between June and October depending on the availability of seedlings or seeds. For *Rhizophora* species and other species with viviparous seeds, the planting time is normally after the seed collection for direct sowing. Operations are mainly conducted by the FD camp workers hired by FD. In the peak season, such as during seedling transportation and planting time, temporary workers are hired from adjacent villages based on necessity.

The mangrove species used in the recent plantation were: *Avicennia officinalis*, *Aegiceras corniculatum*, *Sonneratia apetala*, *Ceriops decandra*, *Heritiera fomes*, *Excoecaria agallocha*, *Bruguiera gymnorrhiza*, *Bruguiera sexangula*, *Xylocarpus moluccensis*, and *Amoora cucullata*. However in terms of quantity, *Avicennia officinalis* is the dominant species, followed by *Sonneratia apetala*, raised and planted in the FD plantations. Non-mangrove species such as *Acacia auriculiformis*, *Eucalyptus camaldulensis*, *Albizia lebbbeck* and *Melaleuca* species were also planted in highland areas but these are more for trials. The planting density is normally 1.8m x 1.8m (6 feet x 6 feet) regardless of the species planted and the FD plantations in this area are classified as fuelwood plantations.

The majority of the FD plantations of the early years have already been destroyed or damaged severely. According to the Bogalaly Township FD office, most plantations from 1980 to 1991 were destroyed by illegal cutting and paddy encroachment, and some died due to unsuitable planting techniques. On the other hand, plantations from 1980 to 1983 were burnt and some did not survive in Laputta Township.

Avicennia officinalis and *Sonneratia apetala* are the most popular species used in mangrove reforestation. Although *S. apetala* grew faster than *A. officinalis* in different ground topography, *A. officinalis* is preferred because *S. apetala* is susceptible to stem borer if planted in a high ground level area. *A. officinalis* wood is harder, of better quality, and more resistant to pests and diseases compared to *S. apetala*. *A. officinalis* seedlings are easily raised in the nursery and seeds are more abundant than *S. apetala*. *A. officinalis* seeds can be easily collected on the ground or floating on the water surface. Seeds of *A. officinalis* have a longer viability period compared to *S. apetala*.

Other mangrove species used in plantation such as *Bruguiera gymnorrhiza*, *B. sexangula*, *Avicennia marina* and *Ceriops decandra* performed dismally, especially when planted in unfavorable ground levels. Worse, these species are not suited in the medium, high ground and extremely high ground areas. In the optimum range of its regular habitat, these species are slow growing and only attained small to medium size under their normal range of environment. *Avicennia marina* and *Ceriops decandra* are small-sized trees that usually reach a maximum height of 8-10 m. On the other hand, *Bruguiera gymnorrhiza* and *B. sexangula* attained a maximum height of 12-16 m under natural conditions. *A. marina* preferred to grow along the coastline and estuaries where saline water inundated the area daily. *Rhizophora apiculata*, *R. mucronata*, and *Avicennia marina* normally prefer to grow in the low-lying areas which can be inundated by high saline brackish water daily.

The ground level range between the low ground to medium ground level is the optimum topography where most of the true mangrove species preferred to thrive. Thus, planting on the low to medium ground level is possible at any time because of suitable environmental

conditions for mangrove growth, particularly the true mangrove species such as *Rhizophora*, *Bruguiera*, *Ceriops*, *Heritiera*, *Aegiceras*, *Avicennia*, *Sonneratia*, *Xylocarpus*, *Excoecaria* and *Lumnitzera* species. But each true mangrove species had its own optimum range of preference to grow at its best.

Although *Avicennia officinalis* can grow in wide ranges of ground level and even survived in extremely high ground level areas, it attained an optimum growth rate up to a certain gradient of high ground level area. Table 4.5 shows the survival rates and mean tree heights of *A. officinalis* in three classified ground levels of a 15-month year old plantation. *A. officinalis* grew faster in low ground areas. It also grew well at medium ground levels but growth slows down in high ground.

It seems that most of the mangrove species planted in extremely high ground had very low survival rates and very slow growth. The extremely high ground level should be planted with fast growing non-mangrove species that can thrive well in over logged, acidic conditions and tolerate saline water or have a shallow spreading root system.

Budget for establishing the FD plantation is allocated based on a standard cost revised annually. The break down and change of standard cost for establishing one hectare of plantation is described in Table 4.6. The standard cost for the fiscal year 2004 was 26,619ks/ha (10,480ks/acre). Though this standard cost was 1.3 times increased from the fiscal year 2003, 3.2 times increased from the fiscal year 2001, and 6.0 times increased from the fiscal year 1997, the budget allocated for the plantation establishment was still a way beyond the actual expenditure of such plantation establishment.

In consideration of the actual work norms (men-day) for operations under the plantation establishment and the actual daily wages of 500ks paid to workers, the current plantation establishment has difficulty in achieving all of the operations indicated in the standard cost table only from the budget allocated based on the standard cost.

According to the observations and outcomes from the pilot project under the study, one hectare of typical plantation establishment in the study area requires a total of at least 100 men-days for covering all of the work components from site preparation, seedling production, planting, to fire protection activities that are described in the standard cost table. Since a recent actual average wage of the FD labor is 500ks/day, a simple calculation indicates that the labor cost itself exceeds the budget distributed by the standard cost. Though the budget deficiency is obvious, FD staff assigned for plantation establishment normally manage and achieve the target area by adjusting budgets and operations by all available means. For instance, potted seedlings are more promising for survival and growth compared to bare-root seedlings. However, the assigned FD staff tend to use bare-root seedlings or direct sowing that are normally cheaper methods for raising seedlings.

2) Nursery and Seedling Production

Primarily, nurseries are established for providing seedlings to the FD's direct plantation. Normally, surplus seedlings are provided for CF use. Nurseries in the two townships can be classified into the following three types:

Types of FD Nursery in the Study Area

Type	Description
1. Township nursery	Located in/near the township FD office. Seedlings for roadside planting, ornamental trees.
2. Large-scale permanent nursery	Normally has annual production capacity in the order of a million. Fixed nursery beds are aimed at long term usage (more than 5 years). Concurrently, an FD camp is established for operation of the nursery.
3. Temporary nursery	Established inside or adjacent to proposed planting sites. Normally of simple structures aimed for usage of one year and less.

Each township FD office includes a township nursery in its complex. The size of the nursery is not more than half an acre (approximately 0.2ha) and the maximum production capacity is around 25,000 potted seedlings but actual production amount is normally below 10,000. The majority of seedlings produced are upland species for road side planting and ornamental trees. Such seedlings are distributed to residents of the town or planted by instructions from township authorities.

The description of large-scale nurseries in the study area is summarized as follows. Both Byone Hmwe Nursery and Kwa Kwa Ka Lay Nursery produce bare root and potted seedlings at approximate ratios of 60% bare root and 40% potted seedlings. Normally, *Avicennia officinalis* account for approximately 90% and 70% of regular annual production of the Byone Hmwe Nursery and Kwa Kwa Ka Lay Nursery respectively. The Thar Kone Integrated Mangrove Nursery mainly produces potted seedlings, but *Avicennia officinalis* is also a major production species accounting for more than 50% of the seedling production capacity.

Existing Large-scale FD Nurseries in the Study Area

Type	Bogalay	Laputta		
Name	Byone Hmwe Nursery	Kwa Kwa Ka Lay Nursery	Thar Kone Integrated Mangrove Nursery	
Location	Compartment 49. Kadonkani Reserved Forest	Compartment 20. Kyakankwinpauk Reserved Forest	Compartment 75 Pyinalan Reserved Forest	
Area	2.0 ha	2.4 ha	1.1 ha (nursery area only)	
Nursery Bed Type	Excavation	Embankment/Excavation	Excavation	
Maximum Production Capacity	2 million seedlings/yr (potted and bare root seedlings)	3 million seedlings/yr (potted and bare root seedlings)	0.75 million seedlings/year (potted seedlings)	
Regular Production	1.5 - 1.6 million seedlings/yr	2 million seedlings/yr	0.75 - 1.2 million seedlings/yr	
Established Year	1998	2000	2003	
Associated Facility	Mangrove garden, mangrove trial woodlot, crocodile cage, aquaculture pond, the FD camp	Demonstration tree garden, trial woodlot, aquaculture pond, the FD camp	CF extension center, Natural mangrove nursery, the FD Camp (mangrove garden), (seed production area), (aqua-agroforestry)	
Remarks	Mainly providing seedlings for the Kadonkani IRM plantation areas	Production temporarily suspended in 2004 because plantation areas shifted to Pyinalan Reserved Forest	Established under the pilot project of the present study. Purpose is for providing seedlings for the CF activities.	

Source: Information from Laputta and Bogalaly Township FD Offices

At present temporary nurseries are established at plantation areas away from the large-scale nursery in Laputta Township. Since the FD plantations are mainly conducted in the Kadonkani IRM areas, the majority of seedlings are transported from the Byone Hmwe Nursery. In the same way as with planting operations, the nursery operation is mainly conducted by FD camp workers, and during peak seasons additional workers are hired from surrounding villages.

3) Natural Forest Operations

Though there are annual targets for natural forest operations (natural regeneration, weeding and thinning), and the annual total achievement areas are recorded at the township FD office in Bogalay and Laputta, details of each operation tend to be missing or not integrated properly in the township office.

(2) Constraints of the FD Conventional Direct Operation

Based on findings from the study, constraints regarding the FD's conventional direct operations in the delta could be generalized as follows.

Constraints Related to FD Direct Operations

1 Monotonous Species Selection and Operation Methods
<ul style="list-style-type: none"> Species selection is heavily concentrated to <i>Avicennia officinalis</i> and <i>Sonneratia apetala</i> regardless of ground level. Though there are various aims in mangrove forest plantation, the plantation category is limited to “fuelwood plantation”. Spacing commonly used is 1.8 m x 1.8 m regardless of species and purpose of establishing the plantation.
2. Not Properly Maintained or Continued
<ul style="list-style-type: none"> In plantations, sites tend to be not properly maintained after planting. Weeds and vines tend to overtop and overcrowd the seedlings due to infrequent forest tending operation. In natural forest operations, the actual operation occurs intermittently and operation is heavily concentrated in the first year.
3. Weak Recording and Monitoring.
<ul style="list-style-type: none"> Survival counting is conducted in the initial stage of plantation establishment. However, there tends to be a lack of monitoring and recording activities of previously operated areas. Exact operational areas are normally not clear. Records normally indicate operation areas by compartment. Therefore, the actual area, boundary and other specific information of operational areas is not integrated and it is often difficult to match the record and the actual site in the long run. This results in inefficient monitoring, especially of old plantation sites.
4. Weak Information Sharing
<ul style="list-style-type: none"> Though certain FD staff acquire technical knowledge and experience, including lessons and constraints, of mangrove forest operations, such information is limited to an individual level. The technology is not properly disseminated and accumulated as an organization.
5. Limited Budget Allocation
<ul style="list-style-type: none"> Budget allocation for the FD plantation work is based on yearly standard cost per acre. Though the budget allocation is increasing annually still it is lower than actual expenditure based on the required work. Operational budgets for transportation costs for regular inspection/visits are nominally provided. There is no specific budget related to the CF extension and support of activities.

Source: Based on field interviews and field survey by JICA Study Team

(3) Constraints related to CF Operations

Although FD has wide ranging experience in mangrove nursery operation and plantation establishment, information and support related to technical matters on mangrove forestry have not been effectively shared with the CF user groups. The following constraints were observed in the existing CF operations.

Constraints Related to CF Operations

1. Inappropriate species - site matching.
<ul style="list-style-type: none"> • Most of the existing CF lands are located at high ground levels that are planted with <i>Sonneratia apetala</i>, <i>Avicennia officinalis</i>, and <i>Bruguiera gymnorhiza</i> which survive and grow better in medium ground. • Species selection was unfavorable. Low ground species, such as <i>Avicennia marina</i> was planted in medium ground level.
2. Monotonous Species Selection and Operation Methods
<ul style="list-style-type: none"> • Species selection is heavily concentrated on <i>Avicennia officinalis</i> and <i>Sonneratia apetala</i> regardless of ground level and plantation objectives. • Spacing commonly used is 1.8 m x 1.8 m regardless of species and purpose of establishing the plantation.
3. Insufficient Knowledge and Experience in Natural Forest Operations
<ul style="list-style-type: none"> • In the natural forest, which is subjected to regeneration improvement felling (RIF) or natural forest improvement operations (NFIO), most of the CF participants were not familiar with NFIO/RIF operation, had little technical knowledge in operation, and encountered difficulties in carrying out various tending activities.
4. Insufficient Support
<ul style="list-style-type: none"> • FD has no annual target or budget to promote and support CF. Therefore, seedling support seldom happens. • FD cannot guide and support the CF user groups because of difficulties for visiting villages due to lack of fuel cost for transportation. • The direct assistance of FD is very limited and assistance to the CF participants was mainly conducted under Forest Resource Environment Development and Conservation (FREDA) and United Nations Development Program (UNDP) / Food and Agricultural Organization (FAO) projects.
5. Not properly Maintained or Continued
<ul style="list-style-type: none"> • Most CF plantations are not properly maintained. Weeds and vines are overtopping and overcrowding the seedlings due to insufficient knowledge and difficulties for livelihood. • Survival and growth of trees are not favorable for user groups to continue the CF activities. • Conflicts with illegal harvesting and encroachment lessen incentives for user group members to continue the CF activities.
6. Complicated and/or Confused CF Procedures
<ul style="list-style-type: none"> • In some CF areas, FD required user groups to secure prior approval before the actual tending activities were undertaken, even when user groups already had an approved management plan.

4.2 Current Condition of Agricultural Resource Use and Development in the Study Area

4.2.1 Agriculture

(1) Current Situation of Agricultural Resource Use

According to an agro-ecological zone designated by the land-use division of the Myanmar Agriculture Service, the study area is categorized as the agro-ecological zone “R3S1” (“R3” indicates annual rainfall of above 100 inches (2,540mm) and with two continuous months of dry summer, and “S1” indicates soil of Fluvisols/Gleysols). The agro-ecological zone is normally regarded as poor drainage, low pH, and high salinity areas that are not always favorable for agriculture. However, agriculture is predominant land use in the study area.

The current agricultural species and cultivation areas are shown in the following table. In the study area, the dominant agricultural production is monsoon paddy, coconuts, and nipa palms. Other than these three products, some bean legume species, oil plants, betel nuts and betel leaves, and bananas are found. Vegetables, fruits, and flowers do not appear in the

table because of the small cultivation area and yield, mostly being cultivated in home gardens. Such production is supplemental activities that support marginal villagers' income and nutrition.

Cultivation Area by Species in the Study Area

(Unit: ha)

Crops / RF	Kyakankwinpauk	Pyinalan	Kadonkani	Pyindaye	Total	%
Monsoon Paddy	4,804.4	2,994.4	1,979.2	3,271.6	13,049.6	90.7
Summer Paddy	-	-	3.2	-	3.2	0.0
Sesame	-	-	-	56.8	56.8	0.4
Sunflower	0.4	-	-	32.0	32.4	0.2
Groundnut	-	-	-	1.2	1.2	0.0
Green gram	64.0	210.4	-	4.0	278.4	1.9
Black eyed pea	11.6	28.8	16.0	9.2	65.6	0.5
Black Grain	-	-	-	4.0	4.0	0.0
Cow Pea	-	-	-	7.6	7.6	0.1
Betel Vines	0.4	53.6	-	2.4	56.4	0.4
Betel Nuts	2.4	3.6	2.0	32.4	40.4	0.3
Coconut Palm	44.8	64.4	18.4	334.4	462.0	3.2
Banana	6.4	0.4	-	-	6.8	0.0
Nipa Palm	52.8	114.8	8.0	150.0	325.6	2.3
Others	-	-	0.4	-	0.4	0.0
Sub total:	4,987	3,470	2,027	3,906	14,390	100.0
Total Land	26,972	39,441	54,050	72,553	193,016	-

Note: “-“ means not available

Source: Myanmar Agricultural Statistics (1989/90 to 1999/2000), 2001, Village Profile Survey 2002

Cultivation of summer paddy is only practiced in the northern area of the Kadonkani Reserved Forest where fresh water is available even during the dry season. But its cultivated area is only 17% of total paddy. Oil plants such as sesame, sunflower, and groundnuts, are cultivated in the Pyindaye Reserved Forest. Some legumes, e.g. green gram and black-eyed peas are cultivated in the four reserved forests. The Kyakankwinpauk Reserved Forest is considered the most agriculturally developed among the 5 reserved forests, so that the ratio of cultivated area covers 18% of the Kyakankwinpauk Reserved Forest. The percentage of cultivation areas in the Pyindaye Reserved Forest is lower than that of the Kyakankwinpauk Reserved Forest but the number of cultivated species is more diverse.

1) Unit Yield

The unit yields of crops cultivated in the study area are summarized in the following table. The best yield of the monsoon paddy was recorded as 2.2 t/ha in the Kyakankwinpauk Reserved Forest, and the lowest was 1.7 t/ha in the Pyindaye Reserved Forest. The significant differences among reserved forests were found in betel nuts, coconut, and nipa. The Kyakankwinpauk Reserved Forest produced only 18,000 betel nuts/ha, but the Kadonkani Reserved Forest exceeds 130,000. The nipa thatch production in the Kadonkani

Reserved Forest is under 5,000 sheets/ha, but it is over 9,000 in the Kyakankwinpauk Reserved Forest.

Yields in Reserved Forests

(Unit: kg/ha)

RF/Species	Monsoon Paddy (kg)	Summer Paddy (kg)	Sesames (kg)	Sun-Flower (kg)	Ground-Nut (kg)	Green gram (kg)	Black-eyed pea (kg)
Kyakankwinpauk	2,276		-	73	-	196	245
Pyinalan	2,056	-	-	0	-	286	163
Kadonkani	2,143	2,868	-	0	-	-	1,143
Pyindaye	1,672	-	191	181	992	163	707
Average	2,036	2,868	191	127	992	215	564

RF/Species	Green gram (kg)	Cow pea (kg)	Beatle Vines	Beatle Nuts (#)	Coconut Palm	Banana	Nipa Palm (#)
Kyakankwinpauk	-	-	531	17,917	5,363	1,500	9,063
Pyinalan	-	-	1,449	50,938	4,259	1,125	8,845
Kadonkani	-	-	-	131,250	3,380	-	4,375
Pyindaye	163	408	2,449	80,000	4,292	-	8,962
Average	163	408	1,476	70,026	4,323	1,313	7,811

Note: “-“ means not available

Source: Myanmar Agricultural Statistics (1989/90 to 1999/2000), 2001, Village Profile Survey 2002

Average unit yield of all cultivated species in the study area, except for the coconut palm, was below those of national averages and the Ayeyawady Division as shown below.

Comparison of Yield per unit among Reserved Forests, Division and the Country

Species	Unit	Average Yield (kg/ha)		
		RF	Ayeyawady Division	Country
Paddy	Kg	2,036	3,450	3,243
Sesame	Kg	191	361	363
Sunflower	Kg	181	323	355
Ground nut	Kg	992	1,079	1,299
Green gram (Paedesein)	Kg	215	737	674
Black gram (Matapae)	Kg	163	835	797
Cow pea	Kg	408	659	655
Coconuts	Nos	4,323	2,687	2,331

Source: Myanmar Agricultural Statistics (1989/90 to 1999/2000), 2001

2) Size of Agricultural Land and Infrastructure

The following table presents the distribution of households by size of farmland. The farmers with less than 1.2 ha of land are recognized as marginal farmers by UNDP projects. The marginal farmers are classified normally into the “poor group”. More than a quarter of the total households were marginal farmers. Half of the remaining farmer households had access to 1.2 to 4 ha of farmland, and the other half had access to farmland exceeding 4 ha.

Distribution of Households by Size of Farm Land

Farm Size	(unit: %)				
	Kyakankwinpauk (n=390)	Pyinalan (n=442)	Kadonkani (n=481)	Pyindaye (n=1599)	Total (n=2912)
Less than 1.2 ha	2.3	2.3	12.1	41.0	25.1
1.2 < 4 ha	16.4	27.6	42.2	43.3	37.1
4 ha and above	81.3	70.1	45.7	15.8	37.7
Total	100.0	100.0	100.0	100.0	100.0

Source: Village Profile Survey 2002

Although paddy cultivation is a major production activity in the study area, cultivation methods are by no means systematic. Decreasing unit yield causes an increase of abandoned paddy lands. The following table shows a distribution of waste paddy lands. The number of households holding waste paddy lands was 14% of the total households who owned land. The majority of them had waste paddy lands of “under 1.2 ha” and “1.2 ha to 4.0 ha” that corresponded to 52.4 % and 43.3% of the total wasted paddy lands, respectively. Very few households had waste paddy land above 4.0 ha.

Distribution of Households by Size of Wasted Paddy

Size of Wasted Paddy	(unit: %)				
	Kyakankwinpauk (n=2)	Pyinalan (n=24)	Kadonkani (n=33)	Pyindaye (n=338)	Total (n=397)
< 1.2 ha	-	50.0	69.7	51.2	52.4
1.2 - 4.0 ha	100.0	25.0	30.3	45.6	43.3
>4.0 ha	-	25.0	-	3.2	4.3
Total	100.0	100.0	100.0	100.0	100.0

Source: Village Profile Survey 2002

In the study area, there is only rain fed rice cultivation. There is no irrigation canal or reservoir for paddy cultivation. Border ridges of paddy are constructed for prevention of salt-water intrusion. The farmers maintain the ridge with hopes of a yield of paddy. Thus, the maintenance of soil fertility and border ridge are essential to sustain yields. Large-scale farmers who possess land use rights for more than 1.2 ha normally have a rice storage facility for their private use, but middle and small-scale farmers do not. Therefore, the middle and small-scale farmers have to sell all products after harvesting without any price consciousness, and they are distressed with price escalation from before to after harvesting season.

(2) Situation of Supplemental Agricultural Resource Use

1) Vegetables and Fruits

Production of vegetables and fruits are limited in the study area mainly due to fresh water shortage and high salinity. Table 4.7 shows vegetable and fruit species and their frequency in the study area.

The amount of vegetable and fruit production is limited mostly for home consumption.

However, where surplus water is available, villagers produce some species for commercial purposes. During the dry season, most vegetables are transported to villages from the markets in Bogalay, Laputta, and Yangon. The actual price of vegetables at several grocery stores obtained by an inquiry survey conducted by the study team is summarized in Table 4.8. The retail price fluctuates among seasons and there is a tendency that price increases during the dry season.

The villagers' priority for water utilization is 1) drinking, 2) domestic use, 3) animal feeding, 4) selling, and 5) irrigation water for vegetables. This could be the main reason why vegetable production is not common in the study area. The cultivation techniques have to be improved both in productivity and quality. Most vegetables are growing without necessary inputs such as fertilizers, composts, and agri-chemicals. There is no processing of products such as dried mango, dried banana, and dried leaves except for reports of dried aroid (taro) stem for exporting to Korea for production of "kimuchi" (Korean pickles).

Figure 4.1 shows a typical existing integrated farmland for cultivation of vegetables and fruits. A water pond for irrigation to the farm and transplanted fruit seedlings is essential. Varieties of cucumber and wax gourd are produced on shelves made of bamboo frames.

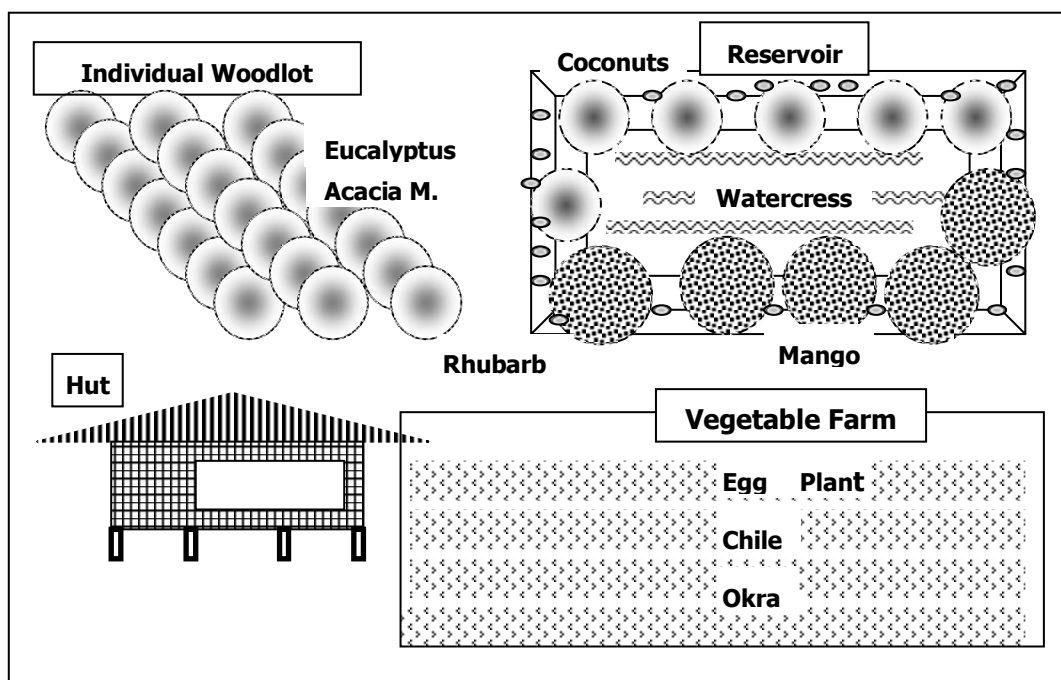


Figure 4.1 Integrated Farm Land in the Study Area

2) Medicinal Plants

Villagers use extracts from certain plants that grow in mangrove forests, such as citrus spp., for daily indispositions. For commercial purposes the villagers collect *Hygrophila obovata* and *Acanthus spp*, which are used in Chinese medicine. After drying the collected plants,

the seeds of the plants are taken out and sold to the merchants from Yangon. From 2001, a plantation of *Acanthus* spp. was started at Chung Bye Gyi village in the Kadonkani Reserved Forest. The seed was sown during July and harvested in November and December. The area of the plantation is approximately 300 m² and produces 320 kg of seed per year. No fertilizer, insecticide, or technical support had been applied. The selling price of the products varies between 450 to 1,200 kyat depending on quality.

(3) Crop Calendar

There are two agricultural high seasons in the study area for the production of the predominant variety of rice. The first busy season starts from June to September for preparation of rice planting and the second active season begins from October to December. The cropping calendar of major agricultural and horticultural crops is shown in Figure 4.2.

(4) Animal Husbandry

Livestock breeding is one of the income generation sources in reserved forests, especially for villagers who do not have land use rights, and mainly women undertake livestock farming activities. Livestock breeding conditions in the study area is summarized in Table 4.9.

The circumstances for rearing livestock are not adequate because of i) no feasible grazing or pasture land, ii) no support by the veterinary/animal husbandry department, the Ministry of Livestock and Fisheries (MOLF) , iii) high cow rental cost, iv) no disease control, v) rapid increase of feed price (rice bran, broken rice, paddy). Outbreaks of livestock diseases occur sporadically in the study area. However the farmers cannot afford to apply vaccinations against the diseases because of the high cost of vaccinations, so the spread of diseases is a great threat in the study area. Table 4.10 describes major livestock diseases in the study area. The HDI projects (up to phase III: - 2001) worked on vaccination of such livestock diseases. Other than the project activities, no vaccination activity was conducted in reserved forests.

Normally, animal dung is wasted in reserved forests. In comparison, collection of cow dung is an important work for farmers to make compost in the central dry zone. The following tables show the survey results of animal dung production in the Ayeyawady Division conducted by the Ministry of Livestock and Fisheries. Table 4.11 indicates approximate composition of animal dung.

Animal Dung Annual Production in Ayeyawady Division

Species	Annual production (kg)
Cattle	780 – 910
Cow	15,000
Bull	8,500
Pig	200
Chicken/ Duck (200 Nos)	4,500

Note 1) Cattle means cow and buffalo grazing at field

2) Cow means for dairy production

3) Bull means cow and buffalo rearing at cattle shed.

Source: Tropical feed, 2001: Livestock Breeding Veterinary Department, Insein, , Yangon, MOLF.

There are various kinds of constraints on animal husbandry, but animal husbandry is an important economic activity for villagers. Compost making from animal dung is one of the potential activities connected with animal husbandry for the sustainable use of mangrove forest. Decreasing paddy yield is a bottleneck for the livelihoods of the villagers, so efficient use of the manure is a potentially rewarding activity. For a stable supply of dung, the measures to be taken are 1) promotion of sanitary cattle barn construction with mosquito nets, 2) promotion of duck and pig cage farming, and 3) extension activities including marketing, livestock sanitation, and vaccination programs.

(5) Agricultural Cooperation

Up to phase III, the HDI project had introduced various kinds of villagers' associations/groups in the study area, but almost all these associations became inactive before the termination of the project. Other than the farmers group, there are neither activities of occupational groups nor those of production and shipping groups.

4.2.2 Agroforestry

(1) Definition of Agroforestry

Agroforestry is a system of land use that integrates trees with crops and/or livestock on the same land management unit. It has been pursued with considerable interest to solve problems faced by farmers particularly in the developing world. Agroforestry has been practiced expecting various kinds of effects such as 1) alleviation of soil erosion, 2) increasing soil fertility and yield, 3) production of several products on the same land and at the same time, and 4) tree shade.

In the study area, there is no question that agroforestry has the potential to address pressing problems in the farming environment, breaking through the usually observed vicious circle of land use, and decreasing population pressure that is currently threatening the mangrove forest.

(2) Current Practice of Agroforestry in the Study Area

Besides home gardens, alley cropping is the only type of adaptable agroforestry technique that can be applied in the study area. Other alternatives, such as hedgerow, contour line planting, and scatter planting could not be suitable for the study area due to limitations in topography and other natural characteristics of the area. The existing agroforestry practice in the study area is designed with three layers of vegetation. The highest stratum of the structure is provided by coconut palms that form an alley. Under the coconut canopy, fruit trees such as lemon, guava, and banana, are planted. At the bottom layer, cucurbit varieties, leafy vegetables, and watercress, are cultivated. This type of agroforestry has been practiced for more than 20 years following exploitation of the coconut plantations in the study area. New agroforestry is being practiced along creeks. This uses a tidal area with a ridge and ditch. The height of the ridge is constructed to be higher than the water level of the spring high tide. The ditch is composed of a water body where enough area is available for raising fish, prawn, and crab. This type of agroforestry is composed of two layers of fruit trees and vegetables or bean legumes. Moreover, the study area has a high potential to introduce an aqua-agroforestry, agroforestry combined with aqua-culture.

(3) Technology Sources of Agroforestry

There are three sources of agroforestry technology in the study area. One is the technology that has been brought into the area by migrants from their old villages. Another is introduced by extension activities of FD. The other is from Myanmar Agriculture Service (MAS) extension activity promoting *Sesbania grandiplona* (Pauk Pan Phyu, leguminous species) to be a potential species for agroforestry. The species promotion is targeted at improvement of soil fertility, food, and fodder trees. Villagers cook leaves for soup and sell bundled leaves to the adjacent market. The stems and leaves are also used for compost. Most agroforestry activities are practiced by the farmers who possess land use rights. Tenant farmers, casual laborers, and fishermen are normally allowed small-scale farming or home gardens on their homesteads by the holders of the land use rights. Thus, even landless people could potentially carry out agroforestry activities in the study area.

4.2.3 Implications of Mangrove Forest Management

(1) Constraints Influencing Mangrove Forests

In the study area, agriculture is the foundation of the home economy, so it is an essential factor to the villagers' livelihoods. However, the following constraints which influence mangrove forest conditions exist as shown in the problem tree (Figure 4.3) below.

1) Insufficient natural resources such as fresh water, soil fertility, and land for cultivation,

- 2) Poorly developed and/or locally unsuitable agricultural practices,
- 3) Not enough sustainable agricultural extension services to villagers,
- 4) Lack of agricultural cooperation and solidarity among villagers,
- 5) Geographical constraints including typical delta formed by low land, high salinity, and creeks dividing land into small pieces, and
- 6) Marginal remote areas situated far from markets.

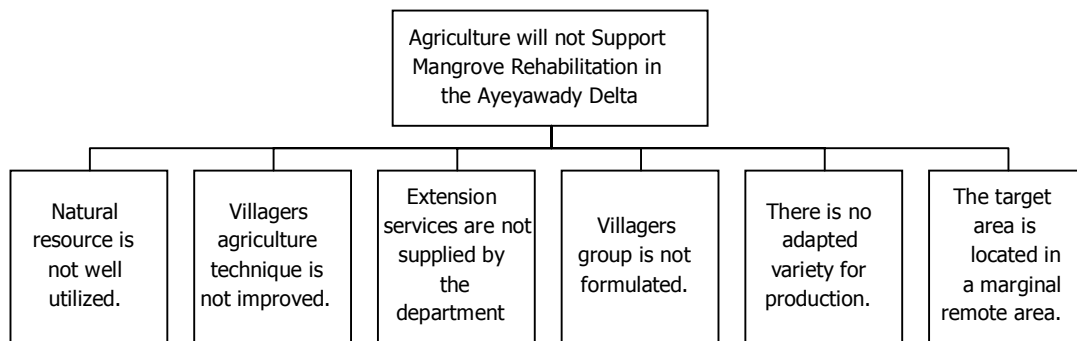


Figure 4.3 Problem Trees of Agricultural Resource Use

(2) Implication on Development of Agricultural Resource Use

Agriculture in the study area is affected by a vicious circle that forces villagers to continuously encroach on natural vegetation because of low agricultural productivity/sustainability from the constraints described above. In return, such a circle causes poverty in the study area. The implication for the development of agricultural resource use is conceptualized as below in Figure 4.4 to attain improvement in the living standard by breaking through the vicious circle.

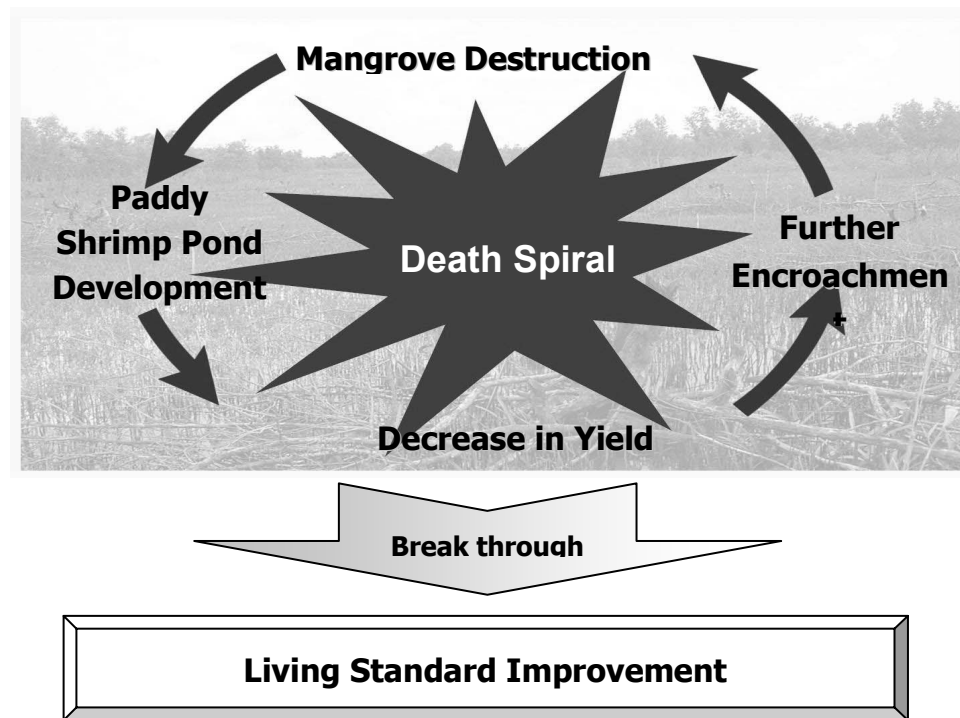


Figure 4.4 Vicious Circle of Agriculture and Living Standard Improvement

(3) Approach of Development of Agricultural Resource Use

A way to break through the vicious circle in the study area is living standard improvement. Thus, the following approach should be taken for preparation of the Living Standard Improvement Plan:

- 1) Officialize agroforestry by means of CF agroforestry,
- 2) Continuous support of agroforestry by FD as one CF activity,
- 3) Develop and demonstrate a CF agroforestry group practicing profitable, sustainable agroforestry including preliminary processing,
- 4) Support development of “one CF agroforestry user group - one product” to enable it to have big production, stable production and supply to market, and
- 5) Introduction of self-reliant micro-credit.

4.3 Aquatic Resource Use and Development

4.3.1 Fishery Resources and Fishery

(1) Production and Fisheries Resources

1) Fisheries Production in Ayeyawady Division

There are 65 species of fish and mollusks and 13 species of crustaceans harvested commercially in the Ayeyawady Division (Angell, 1997). The division is highly productive in estuarine species like *Polynemids*, *Sciaenids*, *Hilsa*, *Harpadon*, sea-eel, and *Penaeid*

shrimp due to enrichment from floodwaters of the Ayeyawady, Sittaung, and Salween rivers. Production levels of freshwater giant prawns *Macrobrachium rosenbergii* in Myanmar are being sustained, because of the country's suitable ecological conditions, and the production of freshwater giant prawn was 0.44 million pieces in the entire country in 2000-2001. From an environmental point of view, the division, with many rivers, rivulets and flooded paddy fields during the monsoon season, offers very good nursery and feeding grounds for the prawn. In the southern part, saline water is accessible from the sea and also brackish water which is very suitable for its breeding and larval development. These factors have contributed to this area becoming one of the richest freshwater prawn fishing grounds in Southeast Asia.

Status of Fisheries in Ayeyawady Division

a) Number of fishermen	53,000 persons
b) Production of Freshwater Fisheries	
- Leasable Fisheries	20,734 tons
- Cultured Fisheries	85,147 tons
- Shrimp Cultured	1,873 tons
c) Production of Marine Fisheries	298,165 tons

Source: Fishery Department, August 2002

2) Fisheries Production in Laputta and Bogalay Townships

Partial data regarding 1) landed volume of fish, prawns, shrimp, and crabs, and 2) numbers of fishing gear by each type in the study area, including both Laputta and Bogalay Townships, were available. However, the numerical data in both townships were not very accurate or complete for political and security reasons. The landed volume of fish, prawns and crabs in Laputta Township decreased from 1995 to 1998, but has increased since 1999. In Bogalay Township, it has increased since 1997. The landed volume data of fish and prawns during 1994 to 1996 are not available, nor is the crab landed volume during 1994 to 2001. Data of the number of items of fishing gear registered by each item in Laputta Township indicate that there is an increasing trend in the amount of fishing gear, such as, stow nets, hilsa nets and fence nets. On the contrary, the number of items of fishing gear such as, croaker nets, catfish nets and stow nets without wings, have shown a stable trend. Data of the number of items of fishing gear registered by each item in Bogalay Township were not available.

3) Fisheries Resources

Although no definite data were available, it can be said that the catch from the rivers and creeks has been declining based on the results of rapid rural appraisal (RRA), and interview surveys conducted under the present study. For instance, in La Mu Oak Ywama village in Bogalay an average fish and other aquatic animals' catch of 32 kg/day/person in the 1980s

dropped to 16 kg/day/person in the 1990s and continued to drop to the level of only 5 kg/day/person at the present. Another example was reported by some villagers in Htan Pin Kwin village in Bogalay that the catch rate of mud crab (*Scylla serrata*) in 1997 was an average of 30 kg/month/person, but it dropped to 10 kg/month/person in the same area. They claimed that crabs were much more abundant until 1992 when a collecting center for fisheries products was constructed and started to operate in the area.

The reason for the decline of fish and crab catches was attributed to an increase in the number of fishermen, over fishing, and the destruction of the mangrove ecosystem (FAO report, 2002). Other reasons suggested by the Fishery Department officials in the regions were that the artisanal fishermen's practice of having not observed closed seasons, protected areas and legal size limits in the regions has adversely affected the fisheries resources. The degree of decline and the situation of standing stock of every species used by local fishermen and the people are not clear.

(2) Fishing Licenses in the Study Area

1) Fishing Licenses in Freshwater Areas

There are two types of fishing licenses, namely leasable fishery and open fishery. The leasable fishery is found in the streams, reservoirs, and ponds that are seasonal in nature, and flooded during monsoons. This fishery in the inland sector is leased out for exploitation and the local Fishery Department collects the revenues. The open fishery is the freshwater fishery of streams, rivers, and lakes not leased out for the leasable fishery. The local Fishery Department has the right to issue fishing licenses. The variation in fishing licenses in freshwater fisheries is listed below. It is noted that the fee is not imposed on simple crab traps and scoop nets.

Fishing License Fees in Freshwater Area as Open Fishery

Types of Fishing Gear	License Fees (Kyats/year)	
	Bogalay	Laputta
Skimming Net (Pouch net)	1,000	1,739
Fence Net	240	112
Drop Net	70	n.a.
Large Bamboo Trap	1,580-7,850	n.a.
Mango fish (King fish) Net	3,630	1,086
River Catfish Net (Modern Skimming Net)	3,630	n.a.

Source: Bogalay and Laputta Township Fishery Department, 2002

In Laputta Township, there is only open fishery, and leasable fishery is absent. In Bogalay Township, leasable fishery can be broken down into two kinds in terms of the licensing procedure. One is to be leased by the Fishery Department in Bogalay Township directly for the ponds or reservoirs in the region. The other is the fishing lot system issued only after a person gets a certain area for engaging in fishing activities through an auction held for each

designated area in the rivers and creeks except for the large rivers. The fishing grounds in large rivers in the region are categorised as open fishery. As of 2002, the number of areas leased directly by the local Fishery Department was 124 including 7 remaining unleased areas, whereas the number of areas held for auction is 355. Data for size and location of each allocated leased area were not available. In Bogalay, the study team often heard that local fishermen have to pay significant amounts of fishing/aquaculture fees to auction heads of the leased areas, which are normally higher than license fees charged by the Fishery Department. However, concrete data for such fee collections were also not available under the present study.

2) Fishing Licenses in Marine Areas and Aquaculture

There is only one type of fishing license, open fishery, issued for marine areas, except for the fishing licenses issued to foreign vessels. The fishing license fee imposed on coastal fisheries to the owners of boats is 3,400 kyat/year/boat and that on offshore fisheries is 9,750 kyat/year/boat. A license is required to engage in aquaculture, and several procedures are necessary for application. Once the license is issued, the fee for the license is payable to the local fishery department at a price of 200 kyat/acre/year.

(3) Relevant Fisheries Infrastructure

As of 2004, there is no fishing port, fish landing site, ice plant or fish processing factory in Laputta or Bogalay Townships, though there is one ice plant in Myaung mya District. There are ports in these townships, although fishermen are not allowed to anchor there to land their catch. The data of the number and location of fish processing factories are not available. However, there seem to be some home made fish processing factories in the townships. Most of the factories process fish and shrimps in the forms of dried fish or as paste.

4.3.2 Extracting Fisheries

(1) Capture Fisheries

Based on the existing reports, 19 different types of fishing gear, as listed in Table 4.12, are used in the study area. This gear provides a rough overview of the impact on the aquatic resources. The gears with the highest impact on aquatic animal populations are trawl nets and stow nets.

There was no reliable data about the composition of the landed volume of each species or the size distribution of the species in either the Laputta or Bogalay Townships. The main targeted species in the Ayeyawady Delta are listed by Seilert (1998) as shown below.

Main targeted Species in the Ayeyawady Delta Area

Species	Freshwater Area	Brackish water Area	Marine Area
Hilsa, <i>Tenualosa ilisha</i>	X		X
Mango Fish, <i>Polynemus spp.</i>	X		
Giant Freshwater Shrimp, <i>Macrobrachium spp.</i>	X		
Catfish, <i>Siluridae</i>	X		
<i>Mysidaceae</i>		X	X
*Barramundi, <i>Lates calcarifer</i>	X	X	
*Mulletts, <i>Mugile spp.</i> , <i>Liza spp.</i>	X	X	
Juvenile Fish		X	
Mud Crab, <i>Scylla serrata</i>		X	
Prawn, <i>Penaeus spp.</i>		X	X
Croaker, <i>Scianidae</i>			X
Pomfret, <i>Stromatidae</i>			X
Mackerel, <i>Scombredae</i>			X
Sharks			X
Rays			X
Butterfish, <i>Stromateidae</i>			X

Note: * Not listed by Seilert (1998) but frequently observed in the study area.

Source: Seilert (1998)

The type and number of boats used for fishing in Laputta Township is described in Table 4.13. (2) Artisanal Fishermen

The casual labour and full time fishermen in the study area are likely to be called artisanal fishermen, except for those who live near by the coastal area and engage in coastal or offshore fisheries. The accurate number of artisanal fishermen is not available due to the lack of surveys related to the local fisheries. At least, there might be around 5,000 to 10,000 artisanal fishermen in Laputta Township based on the data from the local DoF indicating 5,000 small boats which are used by them and considering there are 1-2 persons on board to fish. The gear they use includes hilsa nets, stow nets, and fence nets.

Most artisanal fishermen in the study area appear to catch mud crab (*Scylla serrata*) as a main species of their catch throughout the whole year. The data of catch amount and stocks are not available. However, most people interviewed claimed that the volume of the catch has been declining similar to the comments made by the village leaders in the study area. There is a regulation regarding the minimum size limit of mud crabs of more than 8.15 cm, but they do not seem to comply with the regulation. When they sell those crabs including the ones less than the legal size to the middleman or the person holding the fishing license in the area, the middlemen buying the crabs keep crabs in cages for a while until they grow to a legal size.

The fishermen in the study area are allocated fishing grounds in all creeks and streams except in the large rivers by the fishing lot system, which was introduced in the year 2000. It is one type of the leasable fisheries mentioned in Section 4.3.1 (2). Influential and

wealthy people have the advantage of purchasing fishing lots and earn money from sub-leasing. As a result, many artisanal fishermen, who include most of the landless people, have been deprived of their traditional fishing grounds and lost their main income source unless they work for the people who get the fishing areas through the system.

(3) Processing

Processing of 1) dried fish, 2) fish paste, 3) crab fattening, and 4) other type of processing are common in the study area. The summary of such processing is described in Table 4.14.

4.3.3 Aquaculture

(1) Aquaculture

There are three types of aquaculture, namely extensive, semi-extensive, and intensive. The data of total area of aquaculture in the Ayeyawady Division indicated that there is no area used for intensive aquaculture in the study area as of March 2002.

The extensive form of aquaculture is the most commonly practiced in the division, and in this case the seedlings of fish and crustaceans (shrimp and crabs) simply flow or swim into the water bodies. The water volume is controlled by a gate connecting to outside creeks and rivers. After closing the gate, the water bodies are left without feeding until harvesting the aquatic animals caught inside by drainage of the water. The production of shrimp (*Penaeus spp.*) in extensive aquaculture ponds in Thar Yar Kone village in Laputta is approximately 55 kg/ha/year.

One of the extensive forms of aquaculture characterized by its unique pond design is called “Aqua-silviculture” in Southeast Asian countries. This activity is assisted by the FAO, which has provided training courses, technical advice and finance. This has been experimented with over the last couple of years or so. So far the people practicing this fishery method could harvest 20 kg/ha of giant tiger prawns (*Penaeus monodon*) in addition to mud crabs and other small fish which generate additional income for the people. The post larvae of shrimps as seedlings were collected from the wild thus the people practicing did not pay any money to purchase the seedlings. The semi-extensive form of aquaculture also exists in the study area. However, there is no data describing the contents of the semi-extensive form. Through the field interview survey, only one case of this activity was found in Nyaung Ta Pin village in the Laputta Township, where giant tiger prawn was the prime cultured species yielded. The production, area size, and cultured species are shown in the table below.

Area and Production of Aquaculture Ponds by Type in Laputta Township

	Type of Aquaculture			
	Extensive		Semi-Extensive	Intensive
	Aqua-silviculture	Non Aqua-silviculture		
Area (ha)	2.0 (including flooded area)	0.2	1.2	n.a.
Production (kg/ha)	20 (excluding flooded area)	less than 20	n.a.	55
Species	Giant tiger prawn (<i>Penaeus monodon</i>)	Giant tiger prawn (<i>Penaeus monodon</i>)	Giant tiger prawn (<i>Penaeus monodon</i>) Barramundi (<i>Lates calcarifer</i>)	n.a.

Source: Fishery Department, Bogalay Township, 2003

There are only limited numbers of people practicing aqua-silviculture. In Laputta Township, there are 3,200 ha owned by 80 people. However, the break down of total area and its annual fluctuation in Laputta are not available. The data for the area of aquaculture in Bogalay Township is shown in the table below. The total area of aquaculture of shrimp increased in the fiscal year 2000 by more than 20 times compared to the previous year 1999. The total area of aquaculture increased from 109 ha in 2000 to 158.2 ha in 2001.

Fish and Shrimp Culture Ponds in Bogalay Township (1997-2001)

		1997	1998	1999	2000	2001
Fish Culture Ponds	ha	14.1	14.1	14.1	14.1	31.9
	People	6	6	6	6	13
Shrimp Culture Ponds	ha	4.1	4.1	4.1	94.9	126.3
	People	7	7	7	17	25
Total Area	ha	18.2	18.2	18.2	109.0	158.2

Source: : Fishery Department, Bogalay Township

4.3.4 On-Going and Future Fishery Plan

(1) On-Going Fishery Plan

Basically, on-going fishery activities in the study area are supervised and managed by the Fishery Department of the townships and at district levels in accordance with related laws, rules, and regulations. The major responsibility of the Fishery Department is to collect tender fees and license fees for fishery within their district/township.

1) Problems and Issues in the Study Area

The following major issues could be pointed out regarding the fisheries in the study area:

- a) Decline of fisheries resources,
- b) Fishing lot system in the study area, and
- c) Availability of accurate data regarding fisheries resources.

The decline of fisheries resources has been recognised, not only by Fishery Department

officials in Laputta and Bogalay Townships, but also by most village leaders and artisanal fishermen. It is no doubt that the decline has impacted on the livelihood of fishermen including landless people in the study area.

The fishing lot system which was introduced in some parts of the study area has adversely affected the artisanal fishermen including the landless people engaged in fisheries either almost full time or part time. The fishing lot system itself has been practiced for some time in the past, but was restricted only to limited areas of large-scale commercial fishing grounds which did not deprive the local fishermen significantly. However, it is suggested that the latest introduction of the system in almost all creeks and small rivers in Bogalay has been detrimental to the poor artisanal fishermen, thus the policies on this system should be changed for the villagers to continue with their livelihood. Moreover, it affects the settlement of artisanal fishermen allowing them to be displaced by the person getting the rights to the fishing grounds through the system.

It is difficult to assess the aquatic stocks accurately based on the currently available data. It is essential to collect data, precisely by each township level, such as, landed volume of fish, crabs and shrimps by each species, the number of artisanal fishermen as well as the number of boats actually used by these people.

(2) Future Fishery Plan

As of November 2004, there are no specific fishery related plans covering the study area proposed or scheduled to be implemented. It is expected that the management set up by the fishery department is maintained more or less in accordance with related laws, rules, and regulations.

1) Considerations and Recommendations

The following are a listing of considerations and recommendations for fishery activities in the study area derived from findings of the present study.

- i) Importance of Fisheries and Aquatic Resources for the Villagers
- ii) Improvement of the Existing System
- iii) Required System for Fisheries Activities in the Reserved Forest Area
- iv) Cooperation between the Forest Department and the Fishery Department
- v) Appropriate System of Taxation and Law Enforcement in CF Area

The detail of each consideration and finding is described in Table 4.15.

2) Implication on Mangrove Forest Management - Potential Activities in the Study Area

Based on the current situation, potential fishery activities in the study area in accordance

with the mangrove forest management are aqua-agroforestry, crab fattening, fish culture, and sport fishery. The detail of each potential activity is described in Table 4.16.

Especially aqua-agroforestry (or more commonly known as “aqua-silviculture”) activities under CF have high potential in the study area compared to conventional aquaculture. A practice of intensive aquaculture requires not only advanced technology such as disease treatment, water quality control and diet for cultured species but also a large investment for land, equipment, infrastructure, and skilled staff to manage the ponds. The area needed to cover these costs is naturally large. On the contrary, the aqua-agroforestry categorized as an extensive form does not require such technology and investment. It basically requires management of water level, dikes, and checking predatory fish on a regular basis. Since most CF participants could be landless, engaged in small-scale fisheries or agriculture, a practice of aqua-agroforestry is considered feasible for them. Moreover, they have some experience in fisheries or paddies which enables them to learn the basic knowledge necessary for the culture such as tidal movements, seasonal rain patterns, management of dikes and water level, and aquatic animals.

4.4 Fauna and Flora

4.4.1 On-Going and Future Wildlife Conservation Plan

(1) On-Going Wildlife Conservation

1) Establishment of Protected Areas

Under "The Protection of Wildlife and Protected Areas Law", protected areas are mainly classified into the following three categories: national park, marine park, and wildlife/ bird sanctuary, and necessary conservation activities are performed for the protected area. In the study area, the Meinmahla Reserved Forest was set up as the Meinmahla Wildlife Sanctuary, especially as a protected area for estuarine crocodiles, in 1994. The Kadonkani and Pyindaye Reserved Forests have been examined as candidate areas for extension of the Meinmahla Wildlife Sanctuary.

2) Implementation of Survey

In Myanmar, surveys of important species, such as tiger, asiatic elephant, marine turtles, Ayeyawady dolphin, and orchidaceae plants, were conducted. In the study area, a survey of crocodiles has been conducted along with the inventory survey of birds for the inclusion of different ecosystems, wilderness values, and conservation of endangered species in conservation sites.

3) Legal Enforcement

"The Forest Law" and "The Protection of Wildlife and Protected Areas Law" state strong commitment to nature and bio-diversity conservation. Control of illegal logging and hunting is performed by the township FD offices and nature and wildlife conservation division staff under FD throughout the study area. Particular emphasis was given to the Meinmahla Wildlife Sanctuary and 7 forest camps were settled inside the wildlife sanctuary for protection activities. In the protected reserve area of IRM in Kadonkani Reserved Forests, arrangements for 13 forest camps have been carried out in order to control illegal felling.

4) Problems with Conservation

Problems and constraints with conservation of wildlife in the study area are shown in the following table.

Problems and Constraints with Conservation of the Important Areas

Item
- Though FD staff are assigned for wildlife conservation, their number and capacity is limited to cover the entire Meinmahla Wildlife Sanctuary. Moreover, it is nearly impossible to cover other parts of the study area.
- Though local residents are aware of reserved forests and the wildlife sanctuary, such areas continue to be catching and collection grounds of animals, fish, and fuelwoods for their livelihood.
- Encroachment by paddy and other development activities continue inside reserved forests, thus decreasing natural habitats for wildlife species.
- Target species for wildlife conservation are limited to a few key species, in contrast to a rapid decrease of the mangrove forest ecosystem.

(2) Conservation of Specific Wildlife Species

1) Conservation of Crocodiles

The nature and wildlife conservation division has established the nursery cages/facilities for crocodiles at two places in the Meinmahla Wildlife Sanctuary. About 50% of infant crocodiles which hatched in their nests were captured, and raised up in the nursery cages. One-year-old individuals become the size of about 2 feet. When their survival capability increases, crocodiles are released to their natural habitats. They are marked before release. After the release, regular monitoring is conducted once a year and their growth rate is recorded.

2) Conservation of Marine Turtles

FD and the fishery department have set the protected area for marine turtles in the Kyakankwinpauk and Pyinalan Reserved Forests. Forest guards are assigned by FD. Watchmen are assigned by the fishery department. In order to avoid the predation of eggs by dogs and other animals, eggs are moved inside an enclosed fence. After hatching, eggs are put into a pond and hatchlings are released to the sea. The Fishery Department

designated some small offshore islands, such as Kadonlay island, Gayetkyi island, Hngauthaung island, Maseinyon island and Ngarmanthaung island in the south of the Kadonkani Reserved Forest, as protected areas for marine turtles and established conservation camps. Under current conservation setup, the eggs of marine turtles which are laid along the seashore of Kadonkani and Pyindaye Reserved Forests are well protected from predation and damage.

(3) Future Wildlife Conservation Plan

1) Natural Environmental Conservation Committee

Details of the Natural Environmental Conservation Committee and the special task implementation groups are described in Section 3.1.1 (4). Of the 10 special task implementation groups, the group No.5 is designated for coastal conservation, and one of the group's responsibilities is to protect and conserve bank erosion and destruction of mangrove forests. Therefore, more emphasis on mangrove conservation is expected as a part of the national conservation policy.

A national biodiversity conservation work plan is expected to be prepared by NCEA in collaboration with concerned government departments and organizations.

2) Conservation of Important Wildlife

In order to conserve important wildlife, illegal poaching control is required to be strengthened. In recent conditions, as the number of FD staff runs short absolutely, sufficient patrol work cannot be done. Capacity building of the FD staff is necessary. It is necessary to plan promotion of staff' capacity building through activities such as efficient training courses, promotion of workshops, and seminars given by technicians and experts. In the meantime, it is indispensable to provide more education to local communities for conservation of wildlife and the environment. The protection of the habitat of wildlife should be given priority for the long-term management in the study area.

3) Application to Ramsar Convention

The formal name of the Ramsar Convention is "the Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar". The Ramsar Convention aims at comprehensive conservation including management of basin and conservation of fish resources. Therefore, for promoting integrated conservation management of the Ayeyawady Delta, registering this convention, including issues such as recognition of residents, strengthening of monitoring and continuation of management, can be used effectively in the study area.

Myanmar is now considering the importance of the conservation of wetlands and has set up the Ayeyawady Delta as one of the most important swamps. The Ramsar Convention

recognizes the swamp of Myanmar, and has invited Myanmar as an observer to their meeting. Since then, FD has been coordinating with the Ramsar Convention. Also, preparation of an inventory of wild birds has already been encouraged by the Ministry of Environment and the Wild Bird Society of Japan, and FD is expected to progress formulation of a conservation plan. Myanmar should become a member of the Ramsar Convention, and registration of the Ayeyawady Delta at the Ramsar Convention is expected.

CHAPTER 5 PRESENT SITUATION OF PARTICIPATORY DEVELOPMENT FOR EXTENSION OF COMMUNITY FORESTRY INSTRUCTION

5.1 Participatory Development Projects in the Study Area

Since the issuance of CFI in 1995, more attention has been given to participatory development in Myanmar. In the study area, there are a couple of projects that adopt a participatory development. These are: (1) UNDP-HDI projects, (2) FREDA project and (3) FD activities. The projects are, however, different in approach. In addition, the understanding of the concept of ‘participatory development’ varies among stakeholders. This chapter reviews the characteristics of the project approach, identifies the constraints, evaluates the results, and feeds them back to the design concept for up-coming projects.

5.1.1 UNDP-HDI Project

(1) History of UNDP/FAO project

Since 1991, UNDP/FAO has been the implementing organization for mangrove rehabilitation/ conservation projects. The related projects are shown below.

Summary of mangrove protection-related projects of UNDP/FAO

Project	MYA/90/003	MYA/93/026 (HDI I)	MYA/96/008 (HDI II)	MYA/99/008 (HDI III)
Project term	March 1991 – March 1993	Feb. 1994 – Oct. 1996	Oct. 1996 – Sept 1999	Sept 1999 – Feb. 2002
Target township	Laputta, Bogalay	Laputta, Bogalay	Laputta, Bogalay, Mawlamyinegyun	Laputta, Bogalay, Mawlamyinegyun
Number of target villages	-	48 villages	252 villages	343 villages
Main result in the field of mangrove conservation and forestry	<ul style="list-style-type: none"> – Study of mangrove resources and development of mangrove plantation technique – Pilot plantation of 70.0ha – Technical training of FD personnel – Technical report 	<ul style="list-style-type: none"> – People’s enlightenment about mangrove conservation – Production of seedling of 1.8 million – Wood lot plantation of 1,944 ha – RIF* of 2592 ha – Extension of efficient stove – Technical training 	<ul style="list-style-type: none"> – Provision of material and technique to village nurseries and production of seedling of 1.82 million – Conservation of natural forest of 14,337 ha – CFI of 3608 ha – Riverbank plantation of 45.445 km – Extension of efficient stove – Technical training 	<ul style="list-style-type: none"> – Woodlot plantation of 408.6 ha – Acquisition of CF certificates for 38 user groups – Plantation of 452.4 ha and NFIO of 1064 ha as CF activity – Riverbank plantation of 49.4 km – Seed plantation of mangrove species of 40.5 ha – Extension of efficient stove

Since 1994, mangrove conservation-related projects have been implemented as a part of the Human Development Initiative (HDI) because after the UNDP Governing Council Decision of June 1993, all programs for Myanmar UNDP and related funds had to be clearly targeted towards programs having grassroots level impact in a sustainable manner, particularly in the areas of primary health care, the environment, HIV/AIDS, training and education and food security.

During the project implementation, the purpose of projects has shifted from mangrove resource protection and development of plantation techniques to livelihood improvement and capacity development of the community and community based organizations (CBOs) based on the conservation and use of mangrove resources and also to the environment, food security, and income generating activities. The HDI I was aimed at fulfillment of basic human needs such as food, fuel and income. It adopted a participatory rural development approach and implemented income generation, participatory selection of target villages, and establishment of community based organizations (CBO) by each activity and each purpose. In HDI II, food security, income generating activity and capacity development of community were emphasized by adopting a participatory approach. Promotion of CF was also one of the activities of this project. From this project, mangrove-related activities of UNDP/FAO became a component of environmental conservation. HDI III, followed the components and approach of HDI II.

(2) Activity

The HDI projects in general have involved three stages of project implementation. All of these stages are undertaken in collaboration with community members. These are:

- Participatory needs assessment
- Collective community analysis, discussion and agreement of needs and ways of addressing them
- Capacity/skills building

Based on these concepts, the following activities were supported by UNDP/FAO in target villages in general: establishment of Village Development Committee, formulation of villager's groups by main occupation, village water supply, sanitation group and women income generation group, construction of extension centre, financial support for construction of digging a water pond for drinking water, introduction of toilets, promotion and training of women's income generating activities, and so on. Also, UNDP/FAO supported villagers to organize CF user groups to prepare management plans and apply for a CF certificate, then supported forestry technology and seedlings.

(3) Consequences

Thar Yar Kone, one of the target villages from the of HDI phase II, was supported to establish CBOs during the project implementation period. The CBOs were a village development committee, groups for each occupation, and a women's income generating group. In Nyaung Ta Pin Village, where the HDI phase III project operated, a women's income generating group and a casual labour group were formulated. Extension centers were constructed in both villages to provide a place for villager's meetings. While all projects were formulated based on villager's needs and decisions were made using participatory approach, feasibility was not emphasized.

The group activities became inactive after the HDI phase III finished in February, 2002 and none of the groups are active in October 2004, though the extension center in Nyaung Ta Ping Village is still utilized. In other target villages of the HDI I to III located in the study area in 2004, it was observed that project activities had already become inactive by October 2002.

According to the villagers, the reason of inactivity is lack of necessary managerial and technical knowledge, including marketing or treatment of diseases of domestic animals, difficulty in repaying the credit as quickly as required (just after the project termination), no finance for maintenance and repair of equipment/material supplied by the project and so on. The CBO became non-functional as the incentive and benefit from the project decreased.

(4) On-going Project

The Integrated Community Development Project (ICDP: MYA/01/001) started as phase IV of the HDI in 2002 and is an ongoing UNDP project as of November 2004.

The ICDP has a strong emphasis on the use of participatory methodologies for social learning and building of social capital for local communities.

UNDP explains the aims of the ICDP as follows: to enhance the capacity of the poor through self-help groups and community organizations to help improve their social as well as economic status. Strong emphasis is given to training programs (vocational, skills based, social and educational programs that raise awareness and empower) and linking the community organizations and self-help groups to local support networks. The technical sectors covered by the project include primary health care, community water supply and sanitation, primary education, and environment/food security.

A participatory approach is still adopted, but capacity development of community organizations is emphasized more than in previous projects. The emphasis on training in

the ICDP project indicates that it is directed more clearly towards achieving sustainable community self-reliance in the post-project stage.

5.1.2 FREDA Project

(1) Activity

Forest Resource and Environment Development and Conservation Association (FREDA) is an NGO in Myanmar specializing in forest resources conservation and has been engaged in mangrove conservation projects in Myanmar supported by foreign aid.

FREDA started implementing a 5-year mangrove reforestation program in the Southern Pyindaye Reserved Forest in 1999. This project aimed at the establishment of mangrove plantations based on CF. Its approach was an “integrated type with continuous support to alleviate constraints and difficulties of people” comprising mangrove forest plantation establishment and increase of peoples’ livelihood by means such as 1) mangrove seedling production by user groups for selling and self-plantation, 2) distribution of sewing machines to women’s groups of the user group, 3) fruit and vegetable production by agroforestry 4) school renovation, and 5) CF plantation and natural forest operation.

(2) Consequence

In February 2002, seven villages had organized user groups and had started CF on 676.8 ha (1,671 acre) in total. User group members implemented the CF activity.

(3) On-going Activities

FREDA started implementing a second phase 5-year 550-ha mangrove reforestation project (2004-2008) in the Pyindaye Reserved Forest. This project aimed at the establishment of mangrove plantations applying CFI.

In the project, the components of the mangrove plantation establishment and the livelihood improvement program are the same as in the first phase: 1) mangrove seedling production by CF user groups for selling and self-plantation, 2) distribution of sewing machines to women’s groups of user groups, 3) fruit and vegetable production by agroforestry, 4) village infrastructure support, 5) CF plantation and natural forest operation. As the strong belief of FREDA, in-kind support to user groups for promotion and implementation of CF activities continued.

(4) Performance in the Pilot Project 2003

Besides from its own activity in the Pyindaye Reserved Forest, FREDA was selected as a sub-contractor of the Pilot Project 2003. However, FREDA’s approach was not in

accordance with a participatory development approach, that FD and the study team were looking for in the pilot project implementation. Instead of following the pilot project approach as the subcontractor, FREDa adhered to its own belief and approach conducting in the Pyinalan Reserved Forest.

5.1.3 Forest Department Activity

(1) Activities

After CFI was issued, FD focused their activity on granting CF certificates. As a result, it issued CF certificates to 163 user groups and certified 5,924 ha (14,627 acre) as the CF area by 2000. As of the year 2000, the Ayeyawady Division had the most user groups and largest area under CF in Myanmar due to the projects of UNDP/FAO and FREDa. However, support for CF user groups was not a priority FD activity because revenue collection and direct plantations establishment are considered the main duties of officers and field staff of the township FD office.

FD officers and field staff in the study area do not have sufficient opportunity to practice participatory development except when donors (UNDP, JICA) give assistance. The main activities of the participatory development implemented by FD, especially under support of HDI projects, are the introduction and explanation of CF and supporting villagers to formulate user groups for starting the CF.

CFDTC started the training course of participatory development and CFI, but it did not receive FD officers and field staff from the mangrove area in its training courses as trainees till 2003 except few trainees supported by UNDP.

In the HDI projects, several FD officers of the township FD offices assigned to the project worked for CF extension in collaboration with UNDP/FAO field staff. Through this collaboration, they learnt the participatory development that the HDI projects adopted. For officers who were not assigned to the HDI, they had no chance to learn the concept or experience application of participatory development. Deputy range officers, foresters and forest guards are the field staff who assist range officer with organizing the community to participate in CF. However, it was found during the field survey that they do not have enough knowledge or experience to explain CF to the villagers or to give technical and managerial support to user groups.

In the study area, the forest camps are the front line contact of FD for villagers. However, mainly due to the remoteness of the villages, shortage of staff numbers and budget deficiencies, the actual extension service both of public awareness and support of CF user groups has not been conducted sufficiently in the study area. The following table shows the frequency of visits of the FD field staff to villages recognized by villagers. In the

Bogalay Township, the FD field staff visits many villages, but there are almost no repeat visits or visits to specific villages focusing on specific purposes. In the Laputta Township, the percentage of regular weekly and monthly visits is exceeding that in the Bogalay Township, though the frequency of occasional visits is less than the Bogalay Township.

Visiting Frequency of FD Field Staff to villages

(unit: %)

Frequency of visit	Laputta		Bogalay		Total (n=699)
	Kyakankwinpauk (n=125)	Pyinalan (n=171)	Kadonkani (n=167)	Pyindaye (n=236)	
None	51.2	60.2	8.4	29.7	35.9
Occasional	42.4	38.6	91.6	69.9	62.5
Monthly	5.6	1.2	0.0	0.0	1.3

Note: n= number of interviewees

Source: Village Profile Survey (2002)

(2) Consequence

During the HDI I to III project period, 82 user groups were granted CF certificates by the Myaung Mya District FD Office. Support from FD officers and field staff has become irregular or scarce since the HDI II project finished due to insufficient personnel as mentioned above. Consequently, CF activity of user groups has become inactive in the study area leading to encroachment of paddy cultivation, shrimp culture, and illegal tree cutting in the CF area. The FD offices have taken few measures against these activities.

The type of support requested to FD by villagers is summarized in the following table. It is noted that the ratios of respondents answering “no support from the governments and departments” are high, especially in the Kadonkani Reserved Forest. On the other hand, over 30% of the villagers in the Kyakankwinpauk Reserved Forest expect technical, material and equipment support from the FD. This means that villagers have a different relationship with FD according to the area and the relationship can be improved.

Distribution of Villagers' Requests to be Supported by the FD

(unit: %)

Type of request	Laputta		Bogalay		Total (n=699)
	Kyakankwinpauk (n=125)	Pyinalan (n=171)	Kadonkani (n=167)	Pyindaye (n=236)	
Technical	56.8	40.4	0.6	19.9	26.9
Materials	32.0	17.0	0.0	7.6	12.4
Equipment	32.0	21.1	1.2	11.0	14.9
None	30.4	50.3	98.2	78.0	67.5

Note: n= number of interviewees

Source: Village Profile Survey (2002)

The monitoring of ten FD field staff members in the Laputta Township before the pilot project 2003 showed that they had little understanding of participatory development. They appraised themselves as “having little concept on participatory development”. On

the other hand, they regarded themselves as having moderate knowledge of CF management, since some staff members had experience of providing CF support in the HDI project. According to their understanding, the key point for participatory development is close and frequent communication with user group members. In practice, however, they only go to villages only once or twice a month as needed for their normal duties such as revenue collection.

This is partly because extension activities for CF are not included in the field staff's mandates. In addition, insufficient staff numbers are assigned to extension work.

5.1.4 Participatory Development and Constraints

(1) Overview of Participatory Development practiced in the study area

If considering chronological sequence, a project can be divided into preparation stage, planning stage, implementation stage, and continuation stage (post-project) when the donor's support has finished and beneficiaries conduct activity by themselves. In participatory development, participatory approach must be adopted from the first stage to post project stage.

1) UNDP/FAO project

In the UNDP/FAO HDI projects, a participatory approach was applied to understand the needs of the community and people and to involve the community in decision making. At the preparation stage of the project, information transfer (explanation of the project and scheme) and mutual understanding were employed (UNDP/FAO staff gathered the details and needs and intentions of the community), and the community's participation and project aspects were decided by the community.

At the planning stage, participatory development was applied based on the community's decisions and people's needs to formulate groups, select contents of the project and target people. At the implementation stage, need-based support continued. Also, capacity development was stressed in order that community CBOs could manage and maintain the activity after the project terminated. Other components to prepare continuous activity for the post-project stage were not adequately included in the project, however. A sufficient monitoring system was not set up by either the community or the UNDP/FAO staff, so it was difficult for CBO members to appropriately check the efficiency, effectiveness, applicability or impact of each component and to take necessary measures to overcome obstacles or improve the project.

2) FREDA

It was found in the site survey in 2002 that CF activities and livelihood improvement activities were continued with FREDA's continuous intervention in target villages in the Pyindaye Reserved Forest. According to the FREDA field staff, it planned to continue the same activities in different villages in Pyindaye after the completion of the program in 2003.

At the preparation stage of a project, FREDA staff visits villages to explain the mangrove degradation, CFI, and to promote villagers to organize CF user group by verbal information. It also explains villagers FREDA's livelihood projects. Then, it supports villagers in deciding to participate in the project.

At the planning stage, FREDA supports user groups in writing the application and the CF management plan, because FREDA recognizes these tasks are too difficult for villagers to prepare alone. FREDA headquarters staff believes in-kind support is indispensable to promote the CF to poor villagers, regulates the quantity of rice to be distributed to user group members by each activity of the CF, and instructs the regulation to its field staff.

At the implementation stage, FREDA continues rice distribution for three years. Management and monitoring systems are not sufficiently set up in the CF user groups established with FREDA support.

3) Forest Department

CFDTC training emphasizes that public awareness about the urgency of forest conservation and people's role in it is one of the main activities of the FD.

The following approaches were applied by the FD officers and field staff on site to the extension and support of the CF as methods of participatory development. Because the FD collaborated with the HDI projects they followed the similar approach that the HDI adopted. However, it was observed by the study team that understanding on the participatory development and approaches applied varied among staff and areas.

At the preparation stage, information transfer (explanation of forest conservation and CFI) from the FD officer or field staff to the community and facilitation of decision making of community are applied. At the planning stage, mutual understanding and facilitation of decision making are also applied to formulate a user group and initiate CF. However, after starting the CF, participatory development was not continued, mainly because of the lack of opportunity of visits and insufficient knowledge by FD staff. The number of user groups and area certified for CF are generally used as indicators for evaluation of CF achievement, but the production from the CF area and increase in livelihood level through CF activity are seldom considered as indicators by the FD.

The following table shows the purpose of activity and approaches taken by the FD in the study area, FREDA and UNDP, as seen in their activities or reports.

Participatory Approach Applied in Projects

Organization		Preparation stage	Planning stage	Implementation stage	Post- project / continuation stage
UNDP	Purpose	Involvement of community in projects	Enhancement of ownership		Establishment of sustainable project management
	Approach	Communication with community, mutual understanding Based on the decision making of community			Less emphasis
		Information transfer		Needs-based support, partly in-kind Capacity development of community	
FREDA	Purpose	Promotion and mobilization of community in forest protection			Less emphasis
	Approach	Communication with community			
		Information transfer	Needs-based and in-kind support		
FD in the study area	Purpose	Public awareness of forest protection Involvement of community in forest protection		Enhancement of ownership	Less emphasis
	Approach	Communication with community Consideration of decision making of community			
		Information transfer		Infrequent communication with community after the commencement of the CF	

5.2 Community Forestry User Groups

5.2.1 Social cohesiveness

According to the result of the rapid rural appraisal (RRA) carried out in 20 villagers in the study area, five in each reserved forest, social groups are established inside villages for specific social functions such as Parent and Teacher Association (PTA) or Water and Sanitary Committee (a CBO established in the frame of HDI). Regular meetings of household heads are held in every village to discuss village problems, though the main purpose is the transmission of government orders. Also, religious groups, both Buddhist and Christian, in all villages also serve a function for facilitating communication within the village. Through these social activities, villagers keep connected with important decision making in the village.

As for economic relationship, cooperative work in production is not popular in the study area: farmers employ wage laborers for paddy transplantation and harvesting. Mutual help in emergency cases (disease, starvation) is limited to close relatives, especially in Burmese people. Time sharing for helping paddy cultivation and fishing can be seen in all reserved forests, but it is basically by wage labor.

5.2.2 Participation in CF

At the time of RRA in September 2002, ten of the twenty surveyed villages had already established CF user groups with the support of UNDP/FAO or FRED A and obtained CF certificates.

In the study area up to the HDI phase II, in most of cases, UNDP/FAO staff members in collaboration with the FD officers and field staff visited selected villages to extend the HDI project including the CF activity. Also, in some villages in the Kadonkani Reserved Forest, an officer from the township FD office had explained CFI. In these villages, after the explanation, interested villagers had organized a user group. They applied for CF certification to the district FD office and drew up the management plan with the support of the UNDP, and finally the CF certificate was issued. The main reasons for participation are that user group members can get land use rights and use the barren land effectively.

In order to grasp the level of participation of each social stratum such as farmers (main income comes from cultivation), fisherman, casual labour and others, the participation rate of each social stratum in CF user groups was compared. The participation rate for each stratum was significantly different among the strata and reserved forests. It was found that the participation rate of villagers engaged in casual labour was lower than that of those in agriculture, and the rate of villagers engaged in fishery varied from 0% to 100%. The results indicate that participation in CF is affordable even for casual labours.

Participation rate for each social stratum

Village	Agriculture	Fishery	Casual Labor	Others	Total
Kyakankwinpauk Reserved Forest					
Da Yel Phyu	13%	-	7%	3%	6%
Mi Chaung Ai	-	6%	2%	11%	5%
Pyinalan Reserved Forest					
Ayar Taw	57%	4%	2%	16%	7%
Chan Tar Kone	66%	100%	48%	50%	58%
Poe Laung	38%	30%	26%	0%	27%
Thar Yar Kone	89%	-	79%	80%	82%
Kadonkani Reserved Forest					
Chaung Byi Gyi	57%	44%	19%	-	41%
La Waint Kyun (East)	74%	-	53%	-	61%
Sa Long Kya	29%	50%	56%	-	44%
Pyindaye Reserved Forest					
Pho Oo Zan	25%	0%	2%	20%	8%
Te Pin Seik	6%	0%	4%	8%	6%

Note: Participation rate is calculated by dividing the number of participants for each stratum to total number of HH for each category

Source: RRA (2002)

5.2.3 Willingness to Participate in the CF Activities

Regarding the non-CFI villages, willingness to participate in CF was discussed during RRA. The results reveal that some villagers fear the confiscation of paddy land after establishment of forest plantation. In addition, they do not know so much about how to apply to register for CF.

Impetus to participate in the CF was also discussed at the same time. Although most villagers are preoccupied with daily life and showed no interests in CF, what promoted a few villagers toward CF first was the expectation to get legal land use rights for 30 years. Second impetus was availability of poles, posts and fuelwood from mangrove plantations, while it will take at least five years from the first transplanting. The third impetus was that mangrove plantations generate income. Te Pin Seik in the Pyindaye Reserved Forest raised the impetus to use barren land that is not suitable to paddy cultivation because of intrusion of saline water. In villages where fishermen are predominant, like Mi Chaung Ai in the Kyakankwinpauk Reserved Forest, crab trapping and prawn farming inside CF certified area where land use is exclusively permitted to CF user is tempting.

5.2.4 Villager's Needs

Livelihood problems and villager's needs were also investigated in the RRA. Several livelihood problems were raised at that time, such as lack of capital and production facilities. Lack of capital or investment was ranked as the most severe problem in almost all villages excluding the Kyakankwinpauk Reserved Forest. In the Kyakankwinpauk Reserved Forest, on the other hand, shortage of drinking water was the most severe problem. They ranked these problems as higher priority than mangrove protection in all villages.

These results on villager's needs, for capital or investment, facilities, and drinking water, provide an impetus for mangrove management by villagers through which they can generate income. Income generating components integrated in the CF activity can be an incentive for participation and contributes to improvement of villagers' living standards and the financial success of the CF management. It is appropriate that these income generating components are managed and operated by the management committee of CF user groups or by sub-groups, because these groups could be the foundation of livelihood. .

5.2.5 Constraints to Participation

Villagers of twenty target villages of RRA identified the lack of time for CF activity, precedence of income generating activity, shortage of time for CF activity, and land scarcity as the constraints and reasons for non-participation.

(1) Poverty and Time

Almost half of all households in the study area live in poverty (100,000 kyat/year) according to the village profile survey. Under this condition, villagers regarded the capital and investment as the first needs in the discussion of RRA; therefore, income generation must be considered as the first priority.

According to the villagers, time shortage was a constraint to doing other activities than that relating to livelihood. Especially casual labors explained that almost all time was spent in getting daily food. On the other hand, farmers and fishermen had spare time; farmers had time after the harvest of paddy and fishermen had time off work during the low tide.

(2) Land Scarcity

Because FD normally asks that villagers who intend to apply for CF allocate the land for the CF, the villagers think it is difficult for the landless social strata, such as fisherman and casual labors, to participate in CF unless the other land such as degraded forest is prepared or a communal approach is adopted. Also, in villages where paddy fields extend to all the village area, villagers cannot find the CF area unless there is appropriate area of barren paddy field or degraded forest in or near the village.

(3) Little Knowledge of Villagers on CFI

It was observed during RRA that the some villagers did not understand correctly the system of CFI and its application process. In some cases, the villagers seemed to fear that their paddy land would be confiscated by FD if they applied their land to CF. This situation resulted from the inadequate transfer of information to villagers by FD due to shortage of travel cost and fuel for boats and from the lack of mutual understanding between FD and villagers.

(4) Lack of Community Organizing Function at Field Office Level

Lack of a community organizer who has linkage to both villagers and FD is a constraint for participatory development. Due to this, villager's intention cannot be understood and villagers cannot understand the CF. For a mutual understanding between villagers and FD, a community organizing staff that facilitates a smooth communication is required.

When the desire of CF grows in a village, the villager's intention will be disappointed if assistance from FD for CF extension, distribution of seeds, seedlings, and techniques, which are prescribed in CFI, are not provided at the proper time and proper amount.

CHAPTER 6 PILOT PROJECT 2003 AND 2004

6.1 Background

6.1.1 Objectives, Themes and Target Villages

Under the JICA Study (the study), a pilot project was implemented to confirm practicability of the Integrated Mangrove Management Plan (IMMP) and for capacity building of the stakeholders. Phase I of the study was started from February 2002 and in January 2003 the interim report was prepared for the draft IMMP, the pilot project implementation plan, and mangrove rehabilitation manuals.

The formulated pilot project had primary objectives as follows:

- To obtain data and information to confirm the practicability of the draft IMMP,
- To strengthen the capacity of the stakeholders concerned, and
- To contribute to the actual community forestry (CF) implementation by user groups and the Forest Department (FD).

Based on the above primary objectives, themes to be verified in the pilot project were set as follows:

- Effectiveness of the CF extension,
- Possibility for diversification of the community forestry instruction (CFI).

FD and the JICA study team (the study team) selected the Pyinalan Reserved Forest as the target reserved forest for the pilot project implementation among the five reserved forests, because the reserved forest 1) still has a certain extent of mangrove forest which requires conservation by CF activities, and 2) is one of the priority areas as a candidate site for the Integrated Resource Management (IRM) by FD. Of the five villages in the southern Pyinalan Reserved Forest targeted in the Rapid Rural Appraisal (RRA), Thar Yar Kone village and Nyaung Ta Pin village were selected for the target villages of the pilot project for the reasons indicated in the following table.

Reasons for Selection of Thar Yar Kone and Nyaung Ta Pin Villages

Thar Yar Kone Village
<ul style="list-style-type: none">- Possesses strong unity as a group, and there is competent leadership- Possesses high interest for participating in CF- Already possesses experience in CF activities and thus can serve as a model to other villages- Possible to verify diversification of the CF activities, based on the previous CF experience- Adjacent to a candidate mangrove nursery site for the CF seedling production.
Nyaung Ta Pin Village
<ul style="list-style-type: none">- No experience in the CF activities but possesses high interest and possible to verify effectiveness of the CF extension- Located inside the proposed IRM area, and there is high necessity for joint buffer management and patrolling against illegal activities with FD- Rapid increase in village population, and enlightenment and implementation of mangrove conservation through the CF activities are of urgent necessity.

6.1.2 Timeframe and Component of Pilot Project

The pilot project 2003 was implemented from February 2003 to February 2004. Originally, the pilot project was scheduled to be implemented only during the fiscal year 2003. However, there were requests for the continuation of the pilot project from both FD and the target CF user groups. The request was approved by JICA and the pilot project was continued as the pilot project 2004 for the fiscal year 2004. Based on lessons and findings from the pilot project 2003, the pilot project 2004 was implemented from May 2004 to October 2004. However, implementation of the pilot project 2004 was continued up to January 2005 as a part of “the consideration for the continuation of the pilot project” of the study.

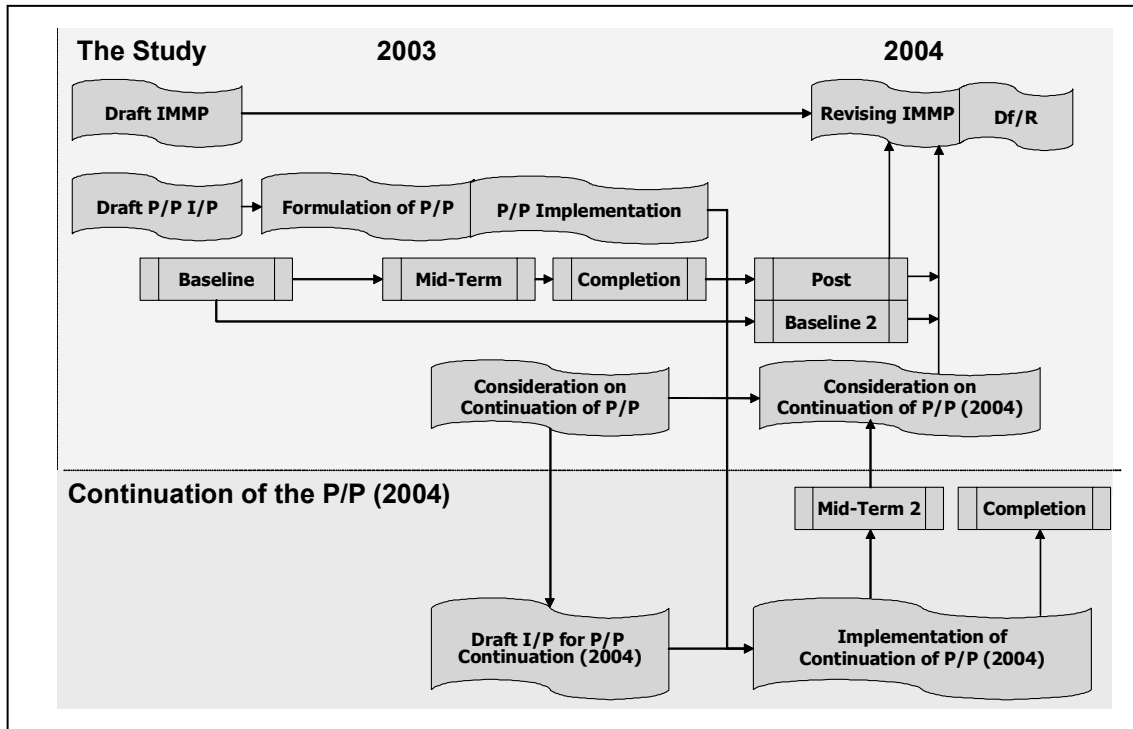
The CF user groups and FD have been fully engaged in planning and drawing the CF management plan, implementation of the activities of the pilot project 2003 and 2004. The components of the pilot project 2003 and 2004 were selected by the stakeholders based on the proposal prepared by FD and the study team that are compiled in the draft IMMP. For, the FD capacity development pilot project in 2004, leftover components of the Thar Yar Kone FD integrated mangrove nursery pilot project in 2003 were included.

Schedule and Components of the Pilot Project 2003 and 2004

Pilot Project	Period	Major Component
Pilot Project 2003	Feb. 2003 –	Planning, implementation and evaluation for:
	Feb. 2004	- Thar Yar Kone Village CF
		- Nyaung Ta Pin Village CF
		- Thar Yar Kone Forest Department Integrated Mangrove Nursery - The Forest Department Frontline Staff Capacity Development
Pilot Project 2004	May 2004 –	Planning, implementation and evaluation for:
	Oct. 2004	- Forest Department Capacity Development
		- Thar Yar Kone and Nyaung Ta Pin CF
	Oct. 2004 –	Planning and implementation for:
	Jan. 2005	- Consideration of pilot project continuation activities - Continuation of remaining pilot project activities

The following Figure shows image flow and relationship of the pilot project 2003, the pilot project 2004, and the study. The obtained lessons through implementation of the pilot project 2004 would be fed back to finalize the IMMP.

The summary of the pilot projects 2003 and 2004 is described in this chapter. Details of the pilot projects are described in the “Volume IV: Pilot Project” of the final report.



Flow and Relationship of the Pilot Project 2003/2004 and the Study

6.2 Pilot Project 2003

6.2.1 Objective and Scope of Works

The pilot project 2003 consisted of four components, namely 1) Thar Yar Kone Village Community Forestry Pilot Project, 2) Nyaung Ta Pin Village Community Forestry Pilot Project, 3) Thar Yar Kone Forest Department Integrated Mangrove Nursery Pilot Project, and 4) Forest Department Frontline Staff Capacity Development Pilot Project. The specific purpose of the pilot project 2003 is shown below:

Specific Purpose of Pilot Project

Pilot Project	Specific Purpose
1) Thar Yar Kone village community forestry	Diversification of CF
2) Nyaung Ta Pin village community forestry	Extension of CF
3) Forestry Department Integrated Mangrove Nursery	Capacity development of FD for supporting the CF activity
4) Forest Department Frontline Staff Capacity Development	Capacity development of the FD frontline staff to extend CF

6.2.2 Target Area

Pilot project sites were in and around the Thar Yar Kone village and Nyaung Ta Pin village located in the forest compartment Nos. 57, 58 and 75 of the Pyinalan Reserved Forest in the Laputta Township. The pilot project area map is indicated in Figure 6.1.

6.2.3 Implementation Procedure

The overall implementation procedures for the pilot project 2003 are indicated in the following table. For the two CF pilot projects, the preparation started from formulation of user groups and certification of the formulated CF user groups in accordance with the procedure designated in CFI. Also, the procurement of a subcontractor was the key procedure for conducting the Thar Yar Kone village CF, the Nyaung Ta Pin village CF, and the FD Integrated Mangrove Nursery pilot projects.

Implementation procedures in Pilot Project 2003

1) Formulation of Pilot Project
<ul style="list-style-type: none"> - Formulation of user groups - Preparation of the CF management plans - Preparation of pilot project plans - Approval of the CF management plan and issue of the CF certificates
2) Implementation
<ul style="list-style-type: none"> - Procurement of subcontractor and trainers - Commencement ceremony for the pilot project - Preparation of action plans for pilot project implementation - Organization of implementation setup - Implementation
3) Mid-term Evaluation
<ul style="list-style-type: none"> - Physical progress check - Mutual understanding program - Mid-term evaluation workshop
4) Completion
<ul style="list-style-type: none"> - Completion check (physical progress, evaluation, analysis)
5) Consideration for Continuation

6.2.4 Implementation Framework

The implementation and organizational structure of the pilot project 2003 is described in Figure 6.2. The study team directly conducted the operation and the management of the FD frontline staff capacity development pilot project. On the other hand, a subcontractor of the study team, the Forest Resource and Environment Development and Conservation Association (FREDA), conducted the actual operation and management of the remaining three pilot projects under the study team.

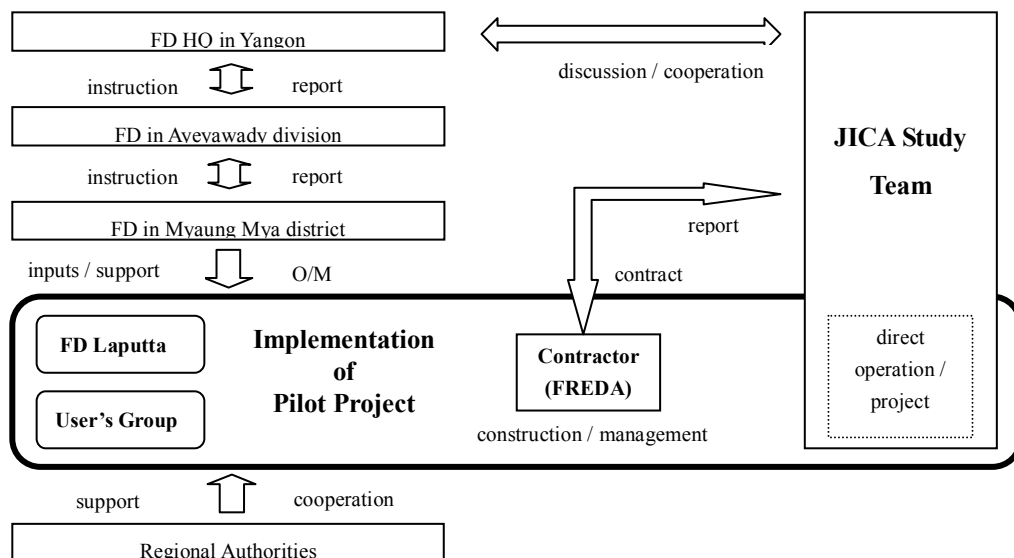


Figure 6.2 Organization Structure of Pilot Project 2003

6.2.5 Components of the Pilot Project 2003

The components of the Pilot Project 2003 are listed as follows. The detail of the components is described in Table 6.1.

Listing of Pilot Project 2003 Component

Thar Yar Kone Village CF Pilot Project	
1. CF Activities - Plantation - Natural Forest Improvement Operation (NFIO) - School Wood Lot (the CF intensification)	3. CF Intensification - School Renovation - Water Filtration Material - School Agroforestry (fruit seedlings)
2. Agroforestry - Nursery - Home Garden	4. Capacity Development - Group Leader Training - Boat tour for mutual understanding
Nyaung Ta Pin Village CF Pilot Project	
1. CF - Plantation - Demo Plantation - NFIO - Demo NFIO - School Woodlot	2. Agroforestry - Homestead/woodlot - Demonstration Farm
	3. Capacity Development - Group Leader Training - Boat tour for mutual understanding
FD Capacity Development Pilot Project	
1. Training of the FD frontline staff at Thar Yar Kone Extension Center	2. Training at Central Forest Development and Training Center (CFDTC)

Thar Yar Kone FD Integrated Mangrove Nursery Pilot Project	
A. Nursery Construction	
1. Nursery Bed - FD type nursery - Natural nursery - Germination bed - Non-mangrove (shading facility) 2. Nursery Road - Main road - Access road - Nursery road 3. Jetty 4. Water Reservoir - Freshwater Pond (80m ³) - Water Tank (concrete / overhead plastic) 5. Stack Yard - Seedling stack yard - Soil Yard (stock pile / mixed soil)	6. Temporary Building - Nursery office - Residence 1 / Residence 2 - Workers hut (x10) - Warehouse 1 / Warehouse 2 - Generator house/Fuel storage, - Seed storage - Rest shade for workers - Incinerator 7. Demonstration and Monitoring - River bank stabilization fence - Water gage station 8. Renovation - Thar Yar Kone CF Extension Center
B. Nursery Operation	
1. Seedling Production 2. Materials & Equipment for Seedling Production	
C. Procurement of Nursery Equipment	
1. For Nursery Operation - Generator, - Pumps (engine/ tread) - Rechargeable battery - Inverter - Seedling transportation boat	2. For Demonstration & Extension - Portable salinity meter/ pH meter - Binoculars

6.2.6 Monitoring and Evaluation Methods

The monitoring and evaluation methods conducted in the pilot project 2003 are summarized in the following table. The mid-term evaluation was conducted in October 2003, and aimed at reflecting the result on further operation and management of the pilot project 2003. The completion check was conducted in February 2004 and its primary objectives were to inspect and evaluate a final achievement of the pilot project 2003, and to obtain key factors and lessons to be integrated in the post evaluation of the pilot project 2003 and the IMMP. Based on the result of the completion check, an evaluation was conducted to identify 1) current assets, 2) anticipated assets, and 3) needs of FD and user groups were evaluated. The factors of current assets and anticipated assets are composed of the five sub-factors; human capital, social capital, physical capital, financial capital and natural capital. The evaluation of the current assets, anticipated assets and the needs are discussed in Chapter 7 of this report.

Generally, regular monitoring and recording by FD, user groups and the subcontractor

(FREDA) were very weak or nearly absent during the implementation of the pilot project 2003. The detail are described in the “Volume IV: Pilot Project” of the final report.

Monitoring and Evaluation Methods of Pilot Project 2003

1) Regular Recording/ Monitoring
<ul style="list-style-type: none"> - Minutes of workshops and meetings - Physical checks by concerned stake holders - Bi-weekly/ monthly progress reports by the CF user groups - Records by FD - Work records and monthly progress reports by subcontractor - Supervision records and monthly progress reports by the study team
2) Mid-term Evaluation
<ul style="list-style-type: none"> - Confirmation of physical progress, problems, and obstacles based on physical checks (site checks) and existing records - Workshops, mutual understanding programs and cross visits for activation and consolidation of potential of the stakeholders - Physical checks, workshops, and interviews for evaluation of development potentials of stakeholders
4) Completion Check/ Evaluation
<ul style="list-style-type: none"> - Self evaluations, surveys, and site checks for achievement and lessons of the CF activities for the TYK and NTP Villages CF Pilot Projects - Site checks for the TYK FD Integrated Mangrove Nursery Pilot Project - Self-evaluations and user group interviews for the FD Frontline Staff Capacity Development Pilot Project

6.2.7 Physical Result

(1) Community Forestry Pilot Projects

Though a component, namely the school woodlots, was not certified under CF, the majority of the planned activities were implemented except for the water filtration component under the CF intensification in the Thar Yar Kone Village CF pilot project. The following table summarizes achievements of the two community forestry pilot projects.

Achievement of Thar Yar Kone Village Community Forestry Pilot Project

Thar Yar Kone Village Community Forestry Pilot Project				
Pilot Project Component		Plan	Achievement(Feb. 2004)	
		Area(ha)	Area(ha)	%
1. CF	Plantation	12.73	11.97	94
	NFIO	28.97	18.81	65
2. Agroforestry	Agroforestry	1.80	1.80	100
	Agroforestry nursery	1 unit (0.11ha)	0.11	100
3. CF Intensification	School woodlot	4.00	4.00	100
	Home garden	0.50	0.50	100
	School renovation	1 unit	1	100
	Water filtration material	1 unit	0	0
	School agroforestry	1 unit (0.03ha)	0.03	100
4. Capacity Development	Group leader training	1 unit	Done	100
	Mutual understanding	1 unit	Done	100

Achievement of Nyaung Ta Pin Village Community Forestry Pilot Project

Nyaung Ta Pin Village Community Forestry Pilot Project				
Pilot Project Component		Plan	Achievement (Feb. 2004)	
		Area(ha)	Area(ha)	%
1. Community	Plantation	5.48	5.28	96
	NFIO	52.06	38.20	73
2. Agroforestry	Demo Plantation	5.00	5.00	100
3. CF Intensification	School Woodlot	0.50	0.50	100
	Homestead/woodlot	30HH (1.00 ha)	1.00	100
	Demo Agro-farm	0.50	0.30	60
4. Capacity Development	Group Leader Training	1unit (training)	Done	100
	Mutual Understanding	1unit (training)	Done	100

In terms of operated area, the plantation was 94% and 96 % achievement, whereas Natural Forest Improvement Operation (NFIO) was 65% and 73% of the original plan for the Thar Yar Kone village user group and the Nyaung Ta Pin village user group, respectively. Both user groups had a similar tendency that the achievement of NFIO was behind the target of the CF management plan by the end of January 2004. In terms of the seedling survival, the Nyaung Ta Pin's plantation and the NFIO-gap planting had an average survival rate of 50 %, while Thar Yar Kone had a lower average survival rate of 35 %. Inappropriate planting techniques and timing, unsuitable species planted and lack of tending (care and maintenance) were some factors that caused the overall average survival rate of 43 % of both plantation and the NFIO areas.

Seedling Survival Rate

Operation	TYK	NTP	Average
Plantation Area	40%	57%	48%
NFIO (Gap Planting)	26%	45%	38%
Average Survival	35%	50%	43%

Agroforestry and the CF intensification components achieved 100% progress in terms of area or unit, except for the water filtration activities in the Thar Yar Kone and the demo agro-farm in the Nyaung Ta Pin. The water filtration activity was not possible because a fresh water source which was targeted for water filtration had been affected by salt water during an abnormal high tide, and not feasible for water filtration. The demonstration agro-farm activity was not completed due to unavailable planting materials that FREDA should have procured.

Group leader training and the mutual understanding program under the capacity development components were originally subcontracted components to be implemented by FREDA. However, FREDA could not manage to organize the program by itself. Thus the study team took the initiative and two programs were conducted in October 2003 for the mutual understanding program, and from December 2003 to January 2004 for the group

leader training.

(2) Thar Yar Kone FD Integrated Mangrove Nursery Pilot Project

a) Procurement

Up to the completion check, only 7 % procurement for the nursery operation equipment, and 21 % for the nursery equipment were procured by FREDA. However by the termination of the contract, FREDA made efforts to procure the un-procured and unqualified equipment and achieved an increase to 47% and 98% for the nursery operation equipment and nursery equipment respectively. The detail of procured equipment under the pilot project 2003 is summarized in Table 6.2.

Result of Procurement of Nursery related Equipment

Item	Procurement (%) by Cost	
	2 Feb. 2004	15 Feb. 2004
Nursery Operation Equipment	7	47
Nursery Equipment	21	98

b) Construction Management

The study team confirmed approximately 81% progress by the termination of the contract. Nursery beds were evaluated only as 50% completion because the construction was not satisfactory for proper seedling production, though the bed excavated area was in accordance with the action plan. A water reservoir was constructed but intrusion of salty water was identified and it was beyond FREDA's capacity to reconstruct the water reservoir during the contract period. Therefore, the JICA study team evaluated the water reservoir as an incomplete construction. The detail of achieved construction under the pilot project 2003 is summarized in Table 6.3.

Result of Nursery Construction

Component	Progress by Cost (%)
	15 Feb. 2004
1.1 Nursery Bed	52.2
1.2 Nursery Road	98.9
1.3 Jetty	100.0
1.4 Water Reservoir	0.0
1.5 Stack Yard	98.4
1.6 Temporary Building	95.8
1.7 Water Storage	96.7
1.9 Demonstration/Monitoring Facility	84.1
1.10 CF Center Renovation	100.0
(Average %)	80.7

c) Seedling Production

The study team evaluated that only 44% of the total required seedlings for mangrove

species, and only 33% of the total required seedlings for non-mangrove species were acceptable as the achievement of the seedling production by FREDa, which resulted in very low outcome. In terms of the species, 187,000 seedlings of *Avicennia officinalis* were produced, which correspond to 70% of achieved mangrove species production. Only *Bruguiera gymnorrhiza* achieved the target quantity of the 26 species planned and produced. Since, FREDa was not able to provide seedling production records in a timely manner to FD and the study team, the figure and the actual conditions of the seedling production were only available from physical progress checks conducted by the study team during the mid-term evaluation and at the completion check.

Result of Seedling Production

Species	the FD Plan (Target)	the FREDa Record	Acceptable Seedlings	# of Species Fulfilled the Target Amount
Mangrove	600,000 (100%)	292,440 (49%)	264,220 (44%)	1/20
Non-Mangrove	25,000 (100%)	21,000 (86%)	8,143 (33%)	0/06

The detail of seedling produced under the pilot project 2003 is summarized in Table 6.4.

(3) FD Frontline Staff Capacity Development Pilot Project

Two sessions of training at the Thar Yar Kone CF extension center were conducted by the study team for the Laputta Township FD frontline staff (deputy ranger officers and foresters). The training comprised the following subjects, 1) participatory development and the CFI management, 2) mangrove technical guidance, and 3) consolidation activities of CF.

For the training at the Central Forest Development and Training Center (CFDTC), two deputy ranger officers from the Laputta Township were dispatched as the trainees for the CF development training course held in August 2003. However, Laputta Township FD office had dispatched deputy ranger officers who were not assigned as the counterpart staff of the study or the pilot project.

Summary of Training under FD Frontline Staff Capacity Development Pilot Project

Training Name	Description
- Training of FD frontline staff at Thar Yar Kone CF Extension Center	1 st session: May 27 to June 2003 , 5 trainees 2 nd session: October 20 – November 7, 10 trainees
- Training at CFDTC	2 deputy ranger officers from Laputta Township attended the training at CFDTC in August 2003

6.2.8 Outputs of the Pilot Projects

(1) Evaluation Results

In consideration of the pilot project purposes and goals, there were some improvements except for the diversification of the CF activities in the Thar Yar Kone user group through implementation of the pilot project 2003. Agroforestry and school woodlots were initially planned to be the certified activity under CF. However, the activity was not applied and certified as CF during the pilot project 2003 implementation period, due to misunderstandings by stakeholders.

Evaluation Result of the Pilot Project 2003

Project Purpose and Goal	Evaluation
The CF Activity is Diversified by TYK user groups.	Not Achieved
CFI is understood by UsG and by NTP user groups.	Satisfactorily Achieved
The FD Capacity for supporting the CF activity is improved by TYK FD Nursery and Training of the FD Frontline Staff.	Improved but not satisfactorily achieved
The Pilot Project attains Mangrove Rehabilitation.	Improved but not satisfactorily achieved
Participatory mangrove rehabilitation through CFI is accelerated (FD).	Improved but not satisfactorily achieved
Participatory mangrove rehabilitation through CFI is accelerated (FREDA).	Not Achieved

(2) Establishment of Foundation for CF Management and Support in Pyinalan Reserved Forest

Though there were some uncompleted construction, procurement, and functions for the Thar Yar Kone FD integrated mangrove nursery, the constructed nursery and produced seedlings were handed over to FD in February 2004. Further renovations were required for the full function of the nursery, however FD gained a core seedling production in the southern Pyinalan Reserved Forest. Since, CFI states that FD's obligation is to provide seedlings for the first rotation of the CF planting activities, the existence of the nursery served as the foundation for CF management and support by FD.

(3) Lessons Obtained

Through the implementation of the pilot project the following lessons were learned.

- Insufficient maintenance of the CF activities by FD: Though the FD staff and the township office possess potential for administering CF, it was obvious that only limited support and management systems are available from FD for sustainable CF activities. There were no regulations, no format and no budget for the actual CF support and management, nor a plan for the CF promotion.
- Insufficient maintenance of socioeconomic activities: Inside the reserved forest various socioeconomic activities (forestry, agroforestry, paddy, fishery, shrimp ponds, salt

production, settlement, etc.) are causing a decrease of mangrove resources. Most of such activities are not officially permitted and lack appropriate technology, causing further decrease of mangrove resources leading to the vicious circle.

- Limited capacity development of user groups: Though the CF user groups possess intentions to start and implement the CF activities there were some internal difficulties to continue the CF activities. The internal difficulties were lack of experienced leaders, limited opportunities to obtain information, and less experience of the successful CF activities.

From the above-mentioned lessons it can be concluded that, under the existing conditions, there are difficulties for conducting sustainable CF activities in the study area. The difficulties for sustainable CF activities are summarized in the following table.

Difficulties for Sustainable CF Activities

Laputta Township FD office	CF user groups
<ul style="list-style-type: none"> - Existing potential of the FD offices and staff for the CF activities - No formats for operation and management of CFI - No plan for the CFI promotion - No budget for CF 	<ul style="list-style-type: none"> - Good collaboration with Laputta Township FD - Limited capacity of leaders - Limited visible success with the CF activities - Existence of illegal activities / shifting villagers

The identified difficulties were reflected to the Pilot Project 2004 upon formulation of an implementation plan for the Pilot Project 2004.

6.3 Pilot Project 2004

6.3.1 Objective and Scope of Works

The pilot project 2004 was composed of 2 components, 1) Forest Department Capacity Development Pilot Project 2004 (for Management and Support of the Community Forestry) and 2) Thar Yar Kone and Nyaung Ta Pin Village Community Forestry Pilot Project 2004.

The concept of the pilot project 2004, improving the CF supporting capacity of FD and the CF implementation capacity of the CF user groups for enabling the rehabilitation of mangrove resources through sustainable CF activities, was refined from lessons obtained during the implementation of the pilot project 2003. Figure 6.3 visualizes the concept of the pilot project 2004.

The specific purposes of the pilot project 2004 were same as the pilot project 2003. The FD capacity development pilot project was for diversification and capacity development of the CF support by FD, whereas the CF pilot project was for diversification and capacity development of the CF implementation by CF user groups.

The components of the pilot project 2004 were prepared based on the following basic agreement among the user groups, FD and JICA.

- The pilot project 2004 shall include only new activities apart from the pilot project 2003 allowed by CFI and the forest law in the reserved forest,
- The pilot project 2004 shall cover the not accomplished activities planned under the pilot project 2003, and
- The pilot project 2004 shall target only the CF user groups of Thar Yar Kone Village and Nyaung Ta Pin Village.

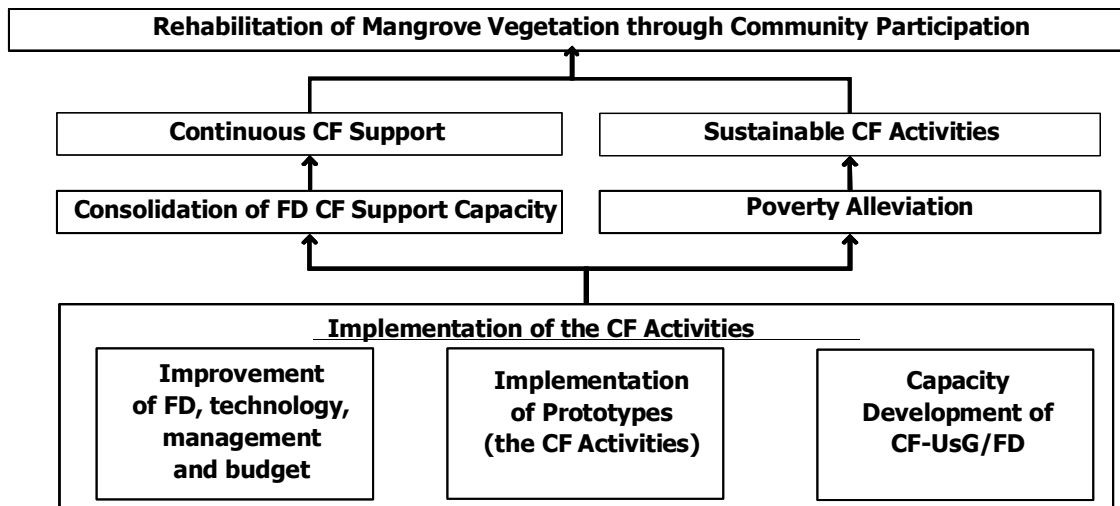


Figure 6.3 Basic Concept of Pilot Project 2004

6.3.2 Target Area

The target pilot project areas for the pilot project 2004 were the same forest compartments as those of the pilot project 2003. The CF target areas under the pilot project 2004 were fixed by means of an update of the CF management plan that was prepared in the course of the pilot project 2003. In addition to the three forest compartments, compartment no. 61 was planned for plantation sites for the CF FD camp, in the course of the pilot project 2004.

6.3.3 Implementation Procedures

The overall implementation procedures for the pilot project 2004 are indicated in the following table. Basically, the pilot project 2004 was prepared, planned and implemented based on the lessons and findings from the pilot project 2003. Also, information sharing and discussions with district level Peace and Development Council, which has important decision makers and authorities for the study area, was initiated in the course of the pilot project 2004 preparation.

Implementation Procedures in Pilot Project 2003

1) Preparation of Pilot Project
<ul style="list-style-type: none"> - Preparation of pilot project plans based on the findings and lessons from FY2003 - Establishment of the FD supporting organization for CF - Information sharing with local authorities at district and township levels - Updating of action plans for 2004 (from 2003 CF management plans) - Confirmation of border lines for the CF areas
2) Implementation
<ul style="list-style-type: none"> - Procurement - Establishment of implementation setup - Implementation of continuation activities of the pilot project 2003 - Implementation of 2003 leftover components - Implementation of new components
3) Completion
<ul style="list-style-type: none"> - Completion check (physical progress, evaluation, analysis)
4) Consideration for the Pilot Project Continuation
<ul style="list-style-type: none"> - Continuous implementation of pilot project 2004 components - Formulation of guideline for the continuation

6.3.4 Implementation Frameworks

The implementation and organizational structure of the pilot project 2004 is described in Figure 6.4. In comparison to the pilot project 2003, all of the pilot project components were conducted under the direct operation and management of the study team with collaborations among FD and user groups. Furthermore, information sharing and cooperation with the local authorities, particularly with the Myaung Mya District Peace and Development Council had been strengthened in the pilot project 2004.

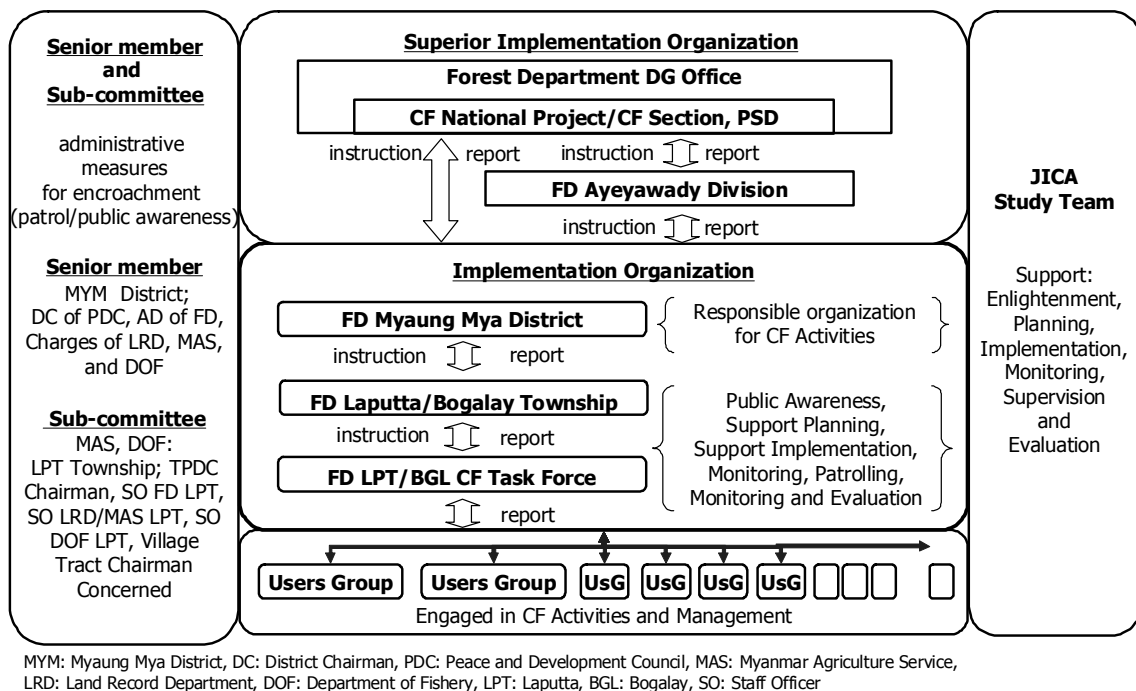


Figure 6.4 Organizational Structure of Pilot Project 2004

6.3.5 Components of the Pilot Project 2004

The components of the Pilot Project 2004 are listed as follows. The detail of the components is described in Table 6.5.

Listing of Pilot Project 2004 Components

FD Capacity Development Pilot Project
<ul style="list-style-type: none"> 1. Establishment of the FD organization for CF <ul style="list-style-type: none"> 1.1 Establishment of Myaung Mya FD CF Task Force 1.2 Establishment of the CF supporting organization for Laputta FD office 2. Institutional Development of FD CF support <ul style="list-style-type: none"> 2.1 Institutional development of the CF task force 2.2 Institutional development of the CF supporting organization (Laputta) 3. Community Forestry Training and Extension Project in Dry Zone (COMFORT) / Mangrove Study Team Counterpart Joint Training 4. TYK FD integrated mangrove nursery 2004 <ul style="list-style-type: none"> 4.1 Nursery operation 4.2 Uncompleted components of pilot project 2003 4.3 Mangrove areas forest management strengthening project 4.4 White charcoal production 5 Patrolling
Thar Yar Kone and Nyaung Ta Pin CF Pilot Project
<ul style="list-style-type: none"> 1. Planning <ul style="list-style-type: none"> 1.1 Update of action plan of management plan prepared under pilot project 2003 1.2 Update of TYK and NTP forest management plan 1.3 Application and trial of sales voucher and license for value added products 2. Implementation <ul style="list-style-type: none"> 2.1 Continuation activities of pilot project 2003 2.2 New activities under pilot project 2004 2.3 Capacity building of user groups and user group members

6.3.6 Monitoring and Evaluation Methods

The monitoring and evaluation methods conducted in the pilot project 2004 were basically the same as that of pilot project 2003, with some modifications especially for report/recording formats for the user group. Also, a mid-term evaluation was not conducted due to the shorter period for the implementation of the pilot project 2004.

The completion check/evaluation was conducted in October 2004 for a post evaluation of the pilot project 2003 and a completion evaluation for the pilot project 2004. The objectives of the evaluation were 1) to integrate the outcome of the pilot project activity, 2) to consider continuation policies for the pilot project, and 3) to revise the IMMP. The completion check was conducted by the study team, FD and user groups through review of monitoring records, site (physical) checks, discussions, workshops, and interviews. Based on the completion check an evaluation was conducted to identify assets and needs of FD and user groups. Also, a socioeconomic condition survey II was conducted to analyze differences in

communities to which target user groups belong, before and after the implementation of the pilot project.

6.3.7 Physical Results: FD Capacity Development Pilot Project

Table 6.6 indicates the final physical result of the FD capacity development pilot project as of January 2005. Hard components such as construction, procurement, production were nearly completed or estimated to be terminated by the end of January 2005. On the other hand, establishment of operation and management systems, preparation of plans/documents related to CF and pilot project activities tended to be delayed or not implemented by FD. The following tables summarize the major achievement of the FD capacity development pilot project.

(1) Establishment of FD Organization for CF Management and Support

<p>1.1 Establishment of Myaung Mya FD CF Task Force</p> <p>The Myaung Mya FD CF monitoring team was established in June 2004, and three members were assigned. The Terms of Reference (TOR) of the team was not formulated, and its activity was limited to accompanying the study team to the pilot project site and attending workshops. Recording and monitoring systems had not been established, either. Office facilities and equipment for the CF monitoring team were procured. Currently, reinforcement of the CF monitoring team to district CF task force is conducted by district FD office for implementation of IMMP phase I.</p>
<p>1.2 Establishment of the CF supporting organization for Laputta FD office</p> <p>The Laputta CF task force was established in June 2004 and four members were assigned. The reserved forest CF promotion, management, support plan, and the CF implementation plan had not been formulated. Equipment and furniture were procured to the Laputta FD office. Currently, in preparation of reserved forest CF task force in accordance with instruction from the district level.</p>

(2) Institutional Development of FD Organization for CF Management and Support

<p>2.1 Institutional Development of CF Task Force</p> <p>The following targeted activities were not prepared or conducted by the Myaung Mya FD CF monitoring team.</p> <ol style="list-style-type: none"> Rules of CF management and support of Myaung Mya FD office Preparation of the form for CF management and supporting activities Application of CF Production Management Regulation (sales voucher, removal pass) Collection of information and reports concerning harvest and sales voucher
<p>2.2 Institutional Development of CF Supporting Organization (Laputta)</p> <p>The following targeted activities were not prepared or conducted by the Laputta CF task force.</p> <ol style="list-style-type: none"> Evaluation and decision for CF production management regulation, coordination with higher offices Granting CF certificates of new CF activities Preparation of FD CF management and support system Formulation of the system of supporting CF management Committee and CF User Group Utilization of the FD operation and management format for CF support. <p>The following targeted activities were partially prepared or conducted</p> <ol style="list-style-type: none"> Activities of the CF task force member for supporting user group: Application from user group of proposal for new type CF activities such as CF aqua-agroforestry, CF water reservoir, etc Support to the user group in planning, application of new CF activities Distribution of seedling of first rotation to the CF user group <p>(Details are described in Table 6.6)</p>

(3) COMFORT/ Mangrove Study Team Counterpart Joint Training

1.1 Establishment of Myaung Mya FD CF Task Force
The training in the dry zone was held from September. 26 to October. 1, 2004, with participation of 7 counterparts from COMFORT and 6 counterparts from the mangrove study.
1.2 Establishment of the CF Supporting Organization for Laputta FD Office
The training was held in the study area from October 18 to 22, 2004 with participation of 5 counterparts from COMFORT and 6 counterparts from the mangrove study.

(4) TYK FD Integrated Mangrove Nursery 2004

4.1 Nursery Operation												
The following targeted activities were not prepared or conducted by the Laputta FD. 1) Establishment and practice of monitoring The following targeted activities were partially prepared or conducted by the Laputta FD. a) Preparation of 2004 FD TYK Nursery Operation Plan b) Nursing of seedlings produced in FY 2003 In addition, following number of seedlings was produced by FD during the pilot project implementation												
<table border="1"> <thead> <tr> <th>Target</th> <th>Produced Seedlings</th> <th>Achievement Rate %</th> </tr> </thead> <tbody> <tr> <td>1,000,000</td> <td>1,000,000</td> <td>100.0%</td> </tr> </tbody> </table>	Target	Produced Seedlings	Achievement Rate %	1,000,000	1,000,000	100.0%						
Target	Produced Seedlings	Achievement Rate %										
1,000,000	1,000,000	100.0%										
c) Plan of measurement and recording of water salinity and tide level d) Management of the facilities for nursery management f) Regular monitoring of the Thar Yar Kone nursery g) Transmission of reports of the result of monitoring of the seedling production to Laputta Township FD office (Details are described in Table 6.6)												
4.2 Uncompleted Components of Pilot Project 2003												
1. Renovation/Finishing Work of Nursery Facility												
1) Nursery Bed Renovation Re-excavation (1,704 m ³), side embankment finishing (976m), and leveling (0.72ha) of nursery beds were conducted at 8 blocks.												
2) Nursery Facility Renovation The following construction and renovation were conducted in the pilot project 2004.												
<table border="1"> <thead> <tr> <th>Component</th> <th>Component</th> </tr> </thead> <tbody> <tr> <td>Nursery main road 1 (mounding and leveling: 91.5m)</td> <td>Worker hut construction (29.3m2x 10)</td> </tr> <tr> <td>Nursery road 1,2,3,4,5,6,7 (side finishing: 610m)</td> <td>Worker hut renovation (30.13m2x 10)</td> </tr> <tr> <td>Seedling stack yard (floor backfilling: 27.61m3)</td> <td>Incinerator construction Ino</td> </tr> <tr> <td>Potting yard (floor backfilling 27.61m3)</td> <td>Concrete (brick) water storage Ino</td> </tr> <tr> <td>Warehouse 2 (construction: 30.13m2)</td> <td></td> </tr> </tbody> </table>	Component	Component	Nursery main road 1 (mounding and leveling: 91.5m)	Worker hut construction (29.3m2x 10)	Nursery road 1,2,3,4,5,6,7 (side finishing: 610m)	Worker hut renovation (30.13m2x 10)	Seedling stack yard (floor backfilling: 27.61m3)	Incinerator construction Ino	Potting yard (floor backfilling 27.61m3)	Concrete (brick) water storage Ino	Warehouse 2 (construction: 30.13m2)	
Component	Component											
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Nursery road 1,2,3,4,5,6,7 (side finishing: 610m)	Worker hut renovation (30.13m2x 10)											
Seedling stack yard (floor backfilling: 27.61m3)	Incinerator construction Ino											
Potting yard (floor backfilling 27.61m3)	Concrete (brick) water storage Ino											
Warehouse 2 (construction: 30.13m2)												
3) Water Reservoir Construction One embankment type water reservoir (16.78 m x 13.73m x ht. 1.83m, 396t capacity) was constructed at the Thar Yar Kone FD nursery												
4) Water Gage Construction Of targeted two water gage (reinforced concrete, up to 5 m measurement), one water gage was constructed at the Thar Yar Kone FD nursery												
5) CF Center Renovation Overhaul of the generator procured during the pilot project 2003 was conducted.												
2. Seedling production of remaining work from 2003												
Leftover Seedlings (7 species)												
<table border="1"> <thead> <tr> <th>Target</th> <th>Produced Seedlings</th> <th>Achievement Rate %</th> </tr> </thead> <tbody> <tr> <td>155,000</td> <td>177,792</td> <td>114.7%</td> </tr> </tbody> </table>	Target	Produced Seedlings	Achievement Rate %	155,000	177,792	114.7%						
Target	Produced Seedlings	Achievement Rate %										
155,000	177,792	114.7%										
(Details are described in Table 6.6)												

(5) TYK FD Integrated Mangrove Nursery 2004 (continued)

<p>3. Procurement of un-procured nursery equipment Equipments for seedling production and nursery management were procured. Also, overhaul of equipment was conducted (details are described in Table 6.6)</p> <table border="1"> <thead> <tr> <th>Component</th> <th>Quantity</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>Equipment for seedling production</td> <td>1</td> <td>1.s.</td> </tr> <tr> <td>Equipment for nursery management</td> <td>1</td> <td>1.s.</td> </tr> </tbody> </table>			Component	Quantity	Unit	Equipment for seedling production	1	1.s.	Equipment for nursery management	1	1.s.
Component	Quantity	Unit									
Equipment for seedling production	1	1.s.									
Equipment for nursery management	1	1.s.									
<p>4.3 Mangrove Areas Forest Management Strengthening Project</p>											
<p>1) Diversification of Mangrove Species Seedling Production (14 species)</p> <table border="1"> <thead> <tr> <th>Target</th> <th>Produced Seedlings</th> <th>Achievement Rate %</th> </tr> </thead> <tbody> <tr> <td>55,000</td> <td>57,752</td> <td>105.0%</td> </tr> </tbody> </table> <p>Details are described in Table 6.6</p>			Target	Produced Seedlings	Achievement Rate %	55,000	57,752	105.0%			
Target	Produced Seedlings	Achievement Rate %									
55,000	57,752	105.0%									
<p>2) Non-Mangrove Species Production (8 species)</p> <table border="1"> <thead> <tr> <th>Target</th> <th>Produced Seedlings</th> <th>Achievement Rate %</th> </tr> </thead> <tbody> <tr> <td>65,000</td> <td>70,803</td> <td>108.9%</td> </tr> </tbody> </table> <p>Details are described in Table 6.6</p>			Target	Produced Seedlings	Achievement Rate %	65,000	70,803	108.9%			
Target	Produced Seedlings	Achievement Rate %									
65,000	70,803	108.9%									
<p>3) Establishment and Operation of Mangrove Garden for Demonstration 9.72 ha of mangrove garden areas was demarcated and established in and adjacent to the nursery area. Within the garden, 6 focal gardens and one terrace garden were established for demonstration. Walking board, and water drainage were constructed, and sign boards, species boards were procured. Planting of 300 seedlings were conducted (details are described in Table 6.6)</p>											
<p>4) Construction and Operation of Aqua-agroforestry for Demonstration Demo aqua-agroforestry ponds (400m² x 2 ponds, water body 220m², land 580m²) were constructed. Agricultural material (seed, seedlings, manure) and aquaculture materials (mesh nets, spades, etc.) were procured but the actual production was not able to start during the pilot project implementation period. (details are described in Table 6.6)</p>											
<p>5) Construction and Operation of Seed Production Area 2.03 ha of seed production areas was demarcated and established with facilities including wooden walking board, seed storage/ observation hut, sign boards, species boards. Planting of 150 seedlings were conducted. (details are described in Table 6.6)</p>											
<p>4.4 White Charcoal Production At the final completion check time, the application for the charcoal production was under preparation by the FD officer in charge of the pilot project.</p>											
<p>4.5 Patrolling The patrolling system was set up in both Thar Yar Kone and Nyaung Ta Pin villages. The action plan was formulated, and demonstration patrolling was practiced by the user groups and FD. The actual patrolling was conducted twice but monitoring and reporting systems were not prepared and conducted by either user groups or the CF task force. Public awareness local workshops were conducted 18 times at 2 districts, 2 townships, 13 villages and Bogalay FD office. Public awareness pamphlet (50,000 copies) and posters (500 copies) were produced and distributed at the workshops and/or concerned townships, village tracts and villages.</p>											

6.3.8 Physical Results: Thar Yar Kone and Nyaung Ta Pin CF Pilot Project

Table 6.7 indicates the final physical result of the CF pilot project as of January 2005. Hard components such as procurement of construction and production materials were nearly completed or estimated to be terminated by the end of January 2005 except for the CF aqua-agroforestry that quantity was reduced and limited to a demo aqua-agroforestry for each village. On the other hand, the actual construction by the CF user group members was still on-going at the end of January 2005. Based on the availability of time and labor, the CF

user group members will continue the remaining works even after the termination of the pilot project 2004. Due to delay in the construction, production activities in agroforestry and aquaculture were not start under CF during the pilot project implementation period.

Preparation and updating of plans/documents related to CF activities were conducted during the pilot project implementation period by the CF user groups with support from FD staff. However, authorization and/or certification of such activities were not given to the CF user groups by FD even at the end of January 25..

The following tables summarize the major achievement of the CF pilot project.

(1) Planning

<p>1.1 Update of action plan of management plan prepared under pilot project 2003</p> <p>The action plan for the management plan prepared under the pilot project 2003 was updated by the two user groups. However, the Nyaung Ta Pin user group, did not submit the updated action plan to FD, because they misunderstood that FD should take care of the updated action plan.</p>
<p>1.2 Update of TYK and NTP forest management plan</p> <p>1. Updating of user group members and allocation of CF area for new members The management plans of Thar Yar Kone and Nyaung Ta Pin village were updated by the user groups for dropped members and new members (Details are described in Table 6.7).</p> <p>2. Land allocation and confirmation of border lines The update of the CF management map was completed by the user group, the CF task force, and the Geographic Information System (GIS) section of FD. The updated CF management maps including new and dropped out user group members, and the new CF activities, were submitted to the CF task force. However, the update CF management map was not authorized by the Myaung Mya District FD office yet.</p> <p>3. Preparation of the revised CF management plan The 8 new comers in Nyaung Ta Pin submitted the management plan to FD in August. The CF user groups prepared the rules and regulations regarding the border line management through holding workshops by the user group and FD.</p> <p>4. Application and permission of revised forest management plan Though FD understood the necessity of the update in order to secure CF rights, the official procedure for amendment to the management plan has not proceeded yet.</p>
<p>1.3 Application and trial of sales vouchers and licenses for value added products</p> <p>1. Improvement of the CF map and harvest plan The user group members did not have any experience and knowledge about the stock estimation of their area, and it was difficult for them to prepare a harvesting plan. In the workshop, FD suggested the user group measure girth and height of trees in their area.</p> <p>2. Application of sales voucher The management committee members and subgroup leaders understood how to use the draft sales voucher. The trial of the sales voucher was not implemented by January 2005 by the user groups and FD. Removal pass was not issued.</p> <p>3. Preparation and application of license for value adding production The license for value added products was not applied by the user group members in the pilot project 2004.</p>

(2) Implementation

2.1 Continuation activities of pilot project 2003						
1. Plantation						
Areas under CF Plantation						
UsG	Target (2003)	Target (2004)	Unit	Result	Rate (2004)	
TYK	3.48	13.42	ha	3.78	28.1%	
NTP	1.95	1.89	ha	1.98	104.8%	
Total	5.43	15.31	ha	5.76	37.5%	
2. NFIO						
Areas under CF NFIO						
UsG	Target (2003)	Target (2004)	Unit	Result	Rate (2004)	
TYK	16.65	57.07	ha	8.39	14.7%	
NTP	42.52	53.19	ha	10.49	19.7%	
Total	59.17	110.26	ha	18.88	17.1%	
2.2 New activities under pilot project 2004						
1. CF Aqua-agroforestry						
Subgroups for the CF aqua-agroforestry were formulated in each village. The subgroups prepared the management plan, and the rules and regulations, and submitted them to FD. Submitted management plan was not yet authorized. Instead demonstration aqua-agroforestry (400m ² x 2 ponds =800m ² , water body 220m ² , land 580m ²) was permitted in each village by FD. Procurement of necessary construction/ aquaculture/ agriculture materials was completed by the end of January 2005. (Details are described in Table 6.7) The construction was started but still on going by both user group as of January 2005						
2. CF FD Camp						
The Laputta township FD officers and laborers organized the user group for the CF FD camp. FD allocated 526.5 ha (1,300 acre) in the forest compartment No. 61 in the Pyinalan Reserve Forest. The management plan and the rules and regulations were prepared in November and December 2004.						
3. CF village woodlot						
The subgroups were formed and the rules and regulations. Management plans were formulated and submitted to FD. Submitted management plan was not yet authorized.						
Areas under CF Village woodlot						
UsG	Target (All)	Target (2004)	Unit	Result	Rate (2004)	
TYK school woodlot	0.81	0.81	ha	0.20	24.7%	
NTP village woodlot	1.94	1.94	ha	1.82	93.8%	
Total	2.75	2.75	ha	2.02	73.5%	
4. CF church woodlot						
The subgroups were formed and the rules and regulations. Management plans were formulated and submitted to FD. Submitted management plan was not yet authorized.						
Areas under CF Church woodlot						
UsG	Target (All)	Target (2004)	Unit	Result	Rate (2004)	
TYK	1.90	0.81	ha	0.20	24.7%	
NTP	0.81	0.81	ha	0.20	24.7%	
Total	2.71	1.62	ha	0.40	24.7%	

2.3 Capacity building of user groups and user group members
<p>1. CF Water Reservoir Construction and Operation The water reservoir subgroup was formulated in both villages in May 2004. Procurement of necessary construction materials was completed by the end of January 2005. (Details are described in Table 6.7). The construction (CF Water Reservoir : 15.25 m x 15.25 m x ht. 1.83m, 396t water capacity) was started by both user groups at the end of October 2004 and still on going by both user group as of January 2005.</p>
<p>2. Training of the CF user group extension workers Totally, 2 trainees each from Thar Yar Kone, Nyaung Ta Pin, Kanbala Ta Pin,, Thaug Lay were selected by the management committee and / or the village authority. Lectures and on-the-job training related to the pilot project 2004 were conducted from May to October 2004, two weeks per month on average. A Study tour and phoenix heart marketing was conducted in January 2005 as a part of the training</p>
<p>3. CF user group women's group The CF women subgroup was formulated with 20 members. The rules and regulations and the processing manual for phoenix was also prepared by the subgroup and the study team. The subgroup arranged the 4 working groups and produced about 300 bottles of phoenix shoots. The trial tasting was held twice in Yangon. The production plan was prepared. However, the bottle procurement for the production was difficult within the pilot project duration.</p>
<p>4. Support monitoring and preparation of progress report of the CF UsG The annual progress report for 2003 was prepared by the user groups, by support and supervision of the study team. The management committee submitted the annual progress report for 2003 to FD in August 2004</p>

6.3.9 Outputs of the Pilot Project 2004

(1) Evaluation Results

The physical output and its evaluation are summarized in the following table. In consideration of the primary objectives and themes (Section 6.1), and the specific purpose of the pilot project 2004 (Section 6.3.1), there were improvements and initiation of unachieved /problematic activities from the pilot project 2003.

Evaluation Result of the Pilot Project 2004

Project Purpose and Goal	Evaluation
CF Activity was Diversified by User Groups	Started but not satisfactorily achieved
Capacity Development of the CF User Groups.	Started but not satisfactorily achieved
CF support and management system by FD was established, improved and diversified.	Started but not satisfactorily achieved
Participatory mangrove rehabilitation through CFI is accelerated (FD).	Improved but not satisfactorily achieved

(2) Establishment of Foundation for the CF Diversification and the CF Management and Support

Though the output of the pilot project 2004 had not fully accomplished the original plan, it was possible to confirm the following items as a foundation of sustainable CF activities for the mangrove rehabilitation in the study area.

- Diversification of the CF Activities: On-going socioeconomic activities inside the reserved forest had been initiated or to be tried as the CF activity, such as the CF

aqua-agroforestry, the CF agroforestry, the CF communal wood lots, and the CF water reservoir. Still many steps are required to officialize such activities as CF. However, the pilot project 2004 served to verify the potential of the diversified CF activity.

- CF Management and Support Setup: Though the setup and activity practiced under the pilot project 2004 for CF management and support by FD were limited and insufficient, the CF monitoring team, the CF task force, the border line management, sales vouchers and removal passes, and public awareness/patrolling revealed constraints and potentials for further CF management and support by FD in the study area.

6.4 Implication for IMMP: Summary of Pilot Project 2003 and 2004

As a summary, through the implementation of the pilot projects 2003 and 2004, the following findings and lessons were obtained.

- Insufficient maintenance of socioeconomic activities inside the reserved forest: Inappropriate technologies and illegal activities are destroying mangroves,
- Diversification of CF activities takes some time for understanding by FD staff and CF user groups. No practical rules or guidelines for the diversification of CF activities,
- Necessity of mangrove nurseries and CF extension centers as foundations for seedling production, CF promotion, and CF management and support,
- Necessity of diversification and integration of mangrove related forestry technology for better practices and outcomes,
- Necessity of introducing regular CF production activities including sales vouchers, removal passes and value-added production. No practical rules or guidelines for the CF production activities,
- Necessity of CF border line management, patrolling, and public awareness for protection of CF areas from conflicts and encroachers,
- Institutional limitations of FD for CF management and support: Insufficient plans and procedures for maintenance of the CF activities, and lacks budget, formats and facilities for CF management and support,
- Possibility and constraints of CF task force or relevant organizations for further CF management and support by FD,
- Limited capacity development of user groups for sustainable CF activities,
- Limited recording and monitoring capacities by both FD and CF user groups,
- Necessity of practical rules and regulations for CF user groups to manage and operate CF activities in accordance with CFI and needs of the CF user group,
- Necessity of practical guidelines and/or bylaws for FD to manage and support CF.

In accordance with evaluated implementation capacity based on assets and needs of CF stakeholders (Chapter 7), the above implications were incorporated as components and activities in the finalized IMMP.