2-4-3 Socio-economic Condition in Ulugan Bay Area

(1) Provincial Level

The Province of Palawan, where Ulugan Bay Area locates, has its limits with Busuanga Island in the north, the Agutaya Group northeast, Cagayancillo in the east and with Balabac Island in the farthest south. The west side faces the South China Sea. As the second largest province in the Philippines, Palawan consists of 1,768 islands, most of which have irregular coastline. Reclining between Mindoro Island and North Borneo, its extreme length is 650 km. The main island measures 425 km. from tip to tip. A chain of tall mountain ranges runs through the entire length of the main island, bisecting it into two distinct areas, the east and the west coasts. The eastern side is characterized by thin strandlines bordered by swamplands, following a series of wide vast plains and valleys ascending gradually to emerge with low rolling hills toward the mountains. The west coast is pinched by craggy foothills and mountains close to the sea. Province of Palawan has a land area of 14,896.55 sq.km, and a population of 640,486 (as of 1995).

Major products of Palawan are; 1)rice, corn, 2)fishery products, 3)cashew. The average annual income of the people in Palawan is 49,327 peso (average in 1994).

The socio-economic feature of Palawan is summarized in Table-2-2U-3.

(2) Municipal Level

Ulugan Bay, is located within the jurisdiction of Puerto Princesa City, the only one City in the Province.

1) Significant Features

Puerto Princesa City is located in the midsection of the long island strip of Palawan Province, with its total land area of 253,982 ha consisting of 66 Barangay. Total population of the City is 129,557 as of 1995, and mostly engaged in agriculture, fishing and service industries.

TABLE 2-2U-3 GENERAL SOCIO-ECONOMIC CONDITION
PROVINCE : PALAWAN

1. General Feature			
Area (ha)		14,896.55 sq.km.	
No. of City		1 (Puerto Princesa City)	
No. of Municipality		23	
No. of Barangay		431	
Population (Total)		640,486 (1996 census)	
(Labor force)		37,900	
(by occupation)	- Agriculture	70.29%	
	- Services	21.76%	
	- Inudstry	7.95%	
Average Annual Income		49,327 peso	
Average Annual Expenditure		41,001 peso	
2. Products			
1) Agriculture	- Palay	59,300 ha	139,565 metric tons
	- Cashew	21,508 ha	24,994 metric tons
	- Coconuts	54,967 ha	57,089 metric tons
	- Corn	23,865 ha	45,303 metric tons
2) Forestry	- Rattan	861,900m	
	- Almaciga	69,340kg	
	- Bamboo	165,830 pieces	
3) Fishery	- Commercial	18,325 metric tons	
	- Municipal	61,522 metric tons	
	- Aquauclture	350 metric tons	
4) Livestocks	- Carabao	30,560 heads	
	- Cattle	20,500	
	- Hog	100,000	
	- Goat	36,000	
	- Chicken	469,434	
	- Duck	37,741	
3. Infrastructure			
Transportation	- Road	Total 4,022.2 km (incl. 366.5km pavement road)	
	- Ports	41 nos.	
	- Airport	21 nos. (Incl. private, military)	
Communication	- Tel company	5 nos.	
	- TV Stations	3 nos.	
Electricity	- Total Capacity	22.41 Megawatts	
	- Served	38,936 hosueholds	
Rural Water Supply	- Level I	15,802 wells	69,606 households
	- Level II	54 systems	4,735 households
	- Level III	22 systems	8024 households
Medical facilities	- Hospital	10 (Gov.), 3 (Private)	
Educational facilities	- College/Univ.	2 (state), 4 (Private)	
	- Highschool	69	
	- Elementary	560	
Agri/fishery facilities	- Pear	52 (major), 43 (minor)	
	- Fishpond	24 nos. (under FLA) (Total 1,429ha)	
	- Irrigation	1 National System, 49 Communal Systems	
	- warehouse	10 (NFA), 50 (Private)	

Source : 1996 Provincial Socio-Economic Profile, PPDO, Prov. Government of Palawan

2) Development Policy/Strategy

According to “1998 Annual Investment Plan” of the City, emphasis of the development strategy of the City are; 1) poverty alleviation, 2) ecological concern, 3) tourism development, 4) basic social services, 5) infrastructure upgrading, 6) increase of investment, and 7) strengthening of local government capability.

(3) Barangay Level

The Study Area is located within the five (5) Barangays, which are:

1) Macarascas
2) Bahile
3) Buenavista
4) Tagbinit
5) Cabayugan

1) Socio-Economic Condition

a. Population

The Barangay in the Study Area has an average number of household of around 230. Average number of Family member is less than 5 person.

The result of the Interview Survey by sampling 200 households from 14 Barangays in the Study Area (hereinafter referred as “the Interview Survey) shows that the average number of family member is 5.3 person (maximum 6.1 in Barangay Tababinit, minimum 4.4 in Barangay Buenavista). Distribution by age is indicated in Table 2-2U-4 as below:

Table 2-2U-4 Distribution by Age (Ulugan Bay)

Age	Ulugan Bay 5 Brgy.(%)	Nationwide Average (%)
0～4	13.6	13.7
5～9	16.4	13.0
10～14	12.3	11.7
15～19	11.5	10.9

20～24	8.3	9.1
25～29	6.8	8.4
30～34	6.5	7.1
35～39	6.2	6.3
40～44	4.8	5.0
45～49	3.8	4.0
50～54	3.2	3.0
55～59	2.7	2.5
60～64	2.0	1.9
65～	1.8	3.5

b. Income Resource, Production, Marketing

In the Barangay in this area, fishery is the main source of income, followed by the rice production. However, agricultural production is occasionally for sale (when there is surplus) and limited for self-consumption. For fishery products, brackish water fish such as Kalapato is the main catch, and shrimps and crabs are not common. Most people in all of these five Barangays sell their products in Puerto Princessa City, since land access can be easily made by commercial-based Jeepney from these area to the City.

The Interview Survey shows that 32.4% of labor force in this Area is engaged in the fishery sector, 21.8% in agricultural sector. Monthly average income is P4,946.90 while expense is P4,159.30. This average income is 0.75 times of the poverty threshold (expense necessary to secure 2,000 calories per family member) in Region-4 where Palawan Province is located, and 1.03 times that of the entire Philippines (average excluding National Capitol Region). Also, this average income is 0.91 times of the average income of fishery household in the Philippines (municipal, inland and fishculture fishery, excluding commercial fishing) which is P5,443.69. As for the employment style, 77.4% of the labor force in the Study Area is self-employed, of which 9.5 % on permanent basis and 13.2% on daily basis. An average of 44.6% of the products from fishery and agricultural sector is domestic consumed. 51.5 % of the respondents sell their product within their Barangays. This is remarkably large as compared to other two Study Areas (39.0% in Aparri Area, 33.5% in Ulugan Bay Area). 39.5 % replied that middlemen/traders visit their area to buy their products.

c. Infrastructures

No Barangay located in this area is electrified and totally depend on their own generators (public and private). Most of Barangays, spring resources are available as their source of water. There are only limited infrastructure in this area, such as one port (pier) in Macarascas and small rice mills in each Barangay. As for educational institute, there are elementary schools in all 5 Barangay, and 3 out of 5 Barangay have highschools. Clinic, day care center are commonly observed in this area, as well as Barangay hall and church.

According to the result of Interview Survey, 98.8% of families possess the houses they are staying. 35.7% of households are electrified, and 89.3% of families have available potable water resources within their Barangay. 60.7% of households replied that they are using firewood as source of fuel (97.5% in Aparri Area, 40.0% in Lamon Bay Area).

d. People's Organization

Aside from religious and woman's groups, there is minimum organized group in this area observed. Only Macarascas has Multi-Purpose Cooperative, however their capital are minimum and they have difficulty in rendering micro-credit to members.

The Interview Survey shows that 25.7% of households in this Area belongs to any people's organizations within their Barangay. Likewise, 11.9% of household replied they are being avail of loan/credits from any organization.

The socio-economic features of these 5 Barangay are summarized in Table-2-4-3 as well as the summary result of interview survey in Table 2-4-4.

Table 2-2U-5 Summary of Socio-economic conditions in Ulugan Bay Area

Items \ Name of Barangay	Bahile	Macarascas	Cabayugan	Buenavista	Tagabinit
1. Population					
a. Number of Household	330	220	289	109	195
b. Average Number of Family Member	4.87	5.01	4.98	4.86	3.80
2. Rural Infrastructure	Spring Dev't - 1	Spring Dev't - 1	Spring Dev't - 2	Spring Dev't - 1	Spring Dev't - 5
	River Intake - 1	Deepwell - 6	deepwell	deepwell - 2	0% electrified
	Deepwell - 6	0% electrified	0% electrified	0% electrified	Generator - 1
	0% electrifieed	Generator -1	Generator - 3	Generator - 1	Rice Mill -1
	Generator - 1	Rice Mill -1	Rice Mill -3	Rice Mill - 1	
	Rice Mill - 4				
	Port Waitingshed -1				
3. Social Infrastructure	Elementary - 1	Elementary - 1	Elementary - 1	Elementary - 1	Elementary - 1
	Highschool -1	Highschool - 1	Highschool - 1	Day Care center - 1	Day Care center - 2
	Day Care Center - 3	Day Care Center - 1	Day Care Center - 1	Church - 2	Clinic - 1
	Clinic - 1	Clinic - 1	Clinic - 1	Barangay Hall - 1	Barangay Hall - 1
	Barangay Hall - 1	Primary - 1	Barangay Hall - 1		Church - 2
	Church - 2	Barangay Hall - 1	Church - 7		
		Church - 6			
4. Average Annual Income	8,350 Peso	8,591 Peso	8,539 Peso	8,333 Peso	6,516 Peso
5. Production (major 2 items)					
a. Forestry	n.a.	n.a.	n.a.	n.a.	1. Almasiga
					(bark, resin)
b. Fishery	1. Kalapato	1. Kalapato	1. Salay-Salay	1. Kalapato	1. Isdang Bato
	2. Bukao	2. Garongong	2. Kalapato	2. Samaral	2. Pusit
c. Agriculture	1. Rice	1. Rice	1. Rice	1. Rice	1. Rice
	2. Corn	2. Corn	2. Mongobean	2. Copra	2. Corn
d. Others	n.a.	n.a.	1. Honey	n.a.	n.a.
6. Major Market/Shopping Place	Puerto Princesa	Puerto Princesa	Puerto Princesa	Puerto Princesa	Puerto Princesa
7. Peoples Organization	Bahile Multi-	Macarascas Multi-	Charity Woman's	Charity Woman's	Samahan ng Maginisda
	Purpose Cooperative	Purpose Cooperative	Association (CWA)	Association (CWA)	at Magsasaka sa
	Farmer's Cooperative		PTA	PTA	Nasunduan
	Charity Woman's			Religious Group	Charity Woman's
	Association (CWA)				Association (CWA)
	PTA				PTA, Religious Group
					Senior Citizen's
					Association
8. Implementation of Legal System					
a. Coastal Environmental Program	On-going	On-going	On-going	On-going	On-going
b. Private Land Lumber Permit	None	None	None	1 - Ipil, Apitong	None
c. Fishpond Lease Agreement	None	None	None	None	1 - 50ha (Prawn)
d. Mangrove Reforestation Project	1 - 100ha	1 - 100ha	None	None	None
e. Mangrove Stewardship Agreement	1 - 5.5ha	None	None	None	None
g. Integrated Social Forest	None	26 - 69.02ha	14 - 30.88ha	1 - 0.25ha	27 - 67.66ha

Table 2-2U-6 : Detailed Socio-economic Condition (Ulugan Bay Area)

CODE				GENERAL		MAJOR INCOME SOURCE						EXPENSES	OTHER ECONOMY			LIVING CONDITION				FISHPOND		
Area Code	Municipality Code	Barangay Code	Sitio/Purok/Zone Code	Average Number of Family Member	Dominant Language/Dialect	Average Monthly Income (in Pesos)	Major Source of Income - Fishery Sector (%)	- Dominant Products	Major Source of Income - Agricultural Sector (%)	- Dominant Products	Major Source of Income - Other Sources (%)	Average Monthly Expenses (in Pesos)	Self-consumption of Products (%)	Availability of Loan/credits (%)	Being member of Cooperatives/Organization (%)	Having own Houses (%)	Availability of Electricity from Local Electric Service Coop. (%)	Availability of Potable Water (%)	Using Fuelwood as Major Fuel (%)	Fishpond Lessee (%)	Fishpond Owner (%)	Intention to have own Fishpond (%)
U	PPS	Total		5.3	Tagalog	4,946.85	30.5	Fish	21.8	Rice	47.7	4,159.32	44.6	11.9	25.7	98.8	35.7	89.3	60.7	0.0	0.0	31.5
U	PPS	BHL	Total	4.6	Tagalog	5,212.48	37.1	Fish	13.3	Rice	49.5	2,603.51	30.9	6.6	12.7	98.0	67.5	96.4	46.6	0.0	0.0	35.1
			BHL-1	4.0	Tagalog	5,500.00	100.0	Fish	0.0	n.a.	0.0	1,473.50	33.8	0.0	0.0	100.0	50.0	75.0	0.0	0.0	0.0	0.0
			BHL-2	4.6	Tagalog	5,537.50	84.0	Fish	0.0	n.a.	16.0	6,178.84	44.1	6.0	6.0	100.0	31.3	100.0	87.5	0.0	0.0	12.5
			BHL-3	4.9	Tagalog	2,628.49	36.4	Fish	0.0	n.a.	63.6	1,898.17	2.9	0.0	43.0	85.7	71.4	100.0	28.6	0.0	0.0	42.9
			BHL-4	4.2	Tagalog	3,434.67	13.6	Fish	18.2	Rice	68.2	2,829.59	19.0	20.0	10.0	100.0	70.0	100.0	60.0	0.0	0.0	30.0
			BHL-5	5.3	Tagalog	6,900.00	15.0	Fish	25.0	Rice	60.0	3,013.03	51.5	20.0	10.0	100.0	90.0	100.0	50.0	0.0	0.0	60.0
			BHL-6	4.4	Tagalog	6,926.67	7.7	n.a.	23.1	Rice	69.2	1,102.61	30.0	0.0	20.0	100.0	100.0	100.0	40.0	0.0	0.0	40.0
			BHL-7	4.6	Tagalog	5,560.00	22.2	Fish	22.2	Vegetable	55.6	1,728.87	35.0	0.0	0.0	100.0	60.0	100.0	60.0	0.0	0.0	60.0
U	PPS	MAC	Total	4.9	Tagalog	4,871.22	37.1	Fish	11.2	Rice	51.7	2,485.21	34.9	21.7	43.8	98.3	48.9	85.6	72.5	0.0	0.0	46.3
			MAC-1	4.5	Cuyunin	5,815.00	31.3	Fish	18.8	Rice	50.0	2,701.37	47.5	25.0	75.0	100.0	25.0	100.0	87.5	0.0	0.0	25.0
			MAC-2	5.0	Tagalog	4,255.00	33.3	Crabs	13.3	Coconuts	53.3	2,607.25	28.1	38.0	75.0	100.0	25.0	100.0	87.5	0.0	0.0	62.5
			MAC-3	4.8	Tagalog	4,756.67	42.9	Fish	7.1	Pawid	50.0	1,931.12	42.5	17.0	33.0	100.0	33.3	83.3	66.7	0.0	0.0	66.7
			MAC-4	4.2	Tagalog	4,643.67	50.0	Fish	12.5	Rice	37.5	1,868.43	30.0	0.0	0.0	100.0	100.0	100.0	50.0	0.0	0.0	66.7
			MAC-5	5.7	Tagalog	5,667.00	57.1	Fish	0.0	n.a.	42.9	2,253.67	30.0	50.0	50.0	100.0	100.0	50.0	83.3	0.0	0.0	16.7
			MAC-6	5.1	Tagalog	4,090.00	22.7	Octpus	13.6	n.a.	63.6	3,549.43	31.0	0.0	30.0	90.0	10.0	80.0	60.0	0.0	0.0	40.0
U	PPS	BNV	Total	4.4	Tagalog	4,290.56	50.0	Fish	22.2	Rice	27.8	582.07	51.1	0.0	0.0	100.0	16.7	83.3	77.8	0.0	0.0	11.1
			BNV-1	3.0	Tagalog	3,375.00	25.0	Fish	25.0	Almasiga	50.0	315.70	55.0	0.0	0.0	100.0	0.0	100.0	100.0	0.0	0.0	50.0
			BNV-2	6.0	Cuyunin	6,600.00	66.7	Fish	16.7	Rice	16.7	714.00	50.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0
			BNV-3	4.0	Tagalog	3,220.00	50.0	Fish	0.0	n.a.	50.0	565.80	50.0	0.0	0.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0
			BNV-4	6.5	Cuyunin	3,830.00	33.3	Fish	16.7	Rice	50.0	631.40	50.0	0.0	0.0	100.0	0.0	100.0	100.0	0.0	0.0	0.0
			BNV-5	4.5	Cuyunin	4,050.00	66.7	Fish	33.3	Vegetable	0.0	594.00	50.0	0.0	0.0	100.0	50.0	50.0	100.0	0.0	0.0	0.0
			BNV-6	5.5	Cuyunin	4,145.00	66.7	Fish	0.0	n.a.	33.3	683.30	50.0	0.0	0.0	100.0	0.0	100.0	100.0	0.0	0.0	0.0
			BNV-7	3.5	Tagalog	4,170.00	33.3	Fish	66.7	Rice	0.0	798.95	55.0	0.0	0.0	100.0	0.0	50.0	100.0	0.0	0.0	0.0
			BNV-8	3.5	Cuyunin	5,375.00	40.0	Fish	20.0	n.a.	40.0	500.72	50.0	0.0	0.0	100.0	0.0	100.0	100.0	0.0	0.0	0.0
			BNV-9	3.0	Cuyunin	3,850.00	75.0	Fish	25.0	Rice	0.0	434.80	50.0	0.0	0.0	100.0	0.0	50.0	0.0	0.0	0.0	50.0

U	PPS	TGB	Total	6.1	Tagalog	5,230.49	23.6	Fish	29.1	Rice	47.3	1,881.47	53.3	16.8	46.7	100.0	17.6	97.9	98.7	0.0	0.0	42.6
			TGB-1	7.3	Tagalog	8,976.43	80.0	Fish	0.0	n.a.	20.0	3,707.20	30.0	14.0	14.0	100.0	0.0	100.0	71.4	0.0	0.0	28.6
			TGB-2	5.9	Tagalog	2,976.19	0.0	n.a.	26.7	Rice	73.3	1,943.88	52.1	29.0	43.0	100.0	42.9	100.0	100.0	0.0	0.0	14.3
			TGB-3	5.3	Tagalog	6,550.00	12.5	Fish	37.5	Rice	50.0	2,557.55	61.3	38.0	50.0	100.0	62.5	87.5	87.5	0.0	0.0	12.5
			TGB-4	6.7	Tagalog	4,138.67	0.0	n.a.	40.0	Almasiga	60.0	944.27	55.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0	0.0	66.7
			TGB-5	6.3	Tagalog	4,408.33	0.0	n.a.	66.7	Cashew	33.3	1,118.85	80.0	20.0	40.0	100.0	0.0	100.0	166.7	0.0	0.0	33.3
			TGB-6	5.3	Tagalog	4,333.33	100.0	Fish	0.0	n.a.	0.0	1,017.06	41.7	0.0	33.0	100.0	0.0	100.0	66.7	0.0	0.0	100.0
U	PPS	CYG	Total	5.9	Tagalog	4,260.77	11.0	Fish	39.0	Rice	50.0	12,810.42	47.5	14.7	25.2	97.9	16.7	83.3	0.0	0.0	0.0	16.7
			CYG-1	5.0	Tagalog	4,831.19	22.2	Fish	11.1	Rice	66.7	3,016.57	50.6	13.0	0.0	87.5	25.0	100.0	62.5	0.0	0.0	25.0
			CYG-2	6.0	Tagbanua	2,290.50	0.0	n.a.	50.0	Rice	50.0	1,891.97	42.3	25.0	0.0	100.0	12.5	50.0	100.0	0.0	0.0	0.0
			CYG-3	6.6	Tagalog	3,361.25	0.0	n.a.	71.4	Rice	28.6	1,585.91	50.0	25.0	38.0	100.0	12.5	75.0	87.5	0.0	0.0	25.0
			CYG-4	5.8	Tagalog	6,246.88	20.0	Fish	40.0	Rice	40.0	2,343.79	36.3	25.0	25.0	100.0	12.5	100.0	75.0	0.0	0.0	25.0
			CYG-5	5.8	Tagalog	4,876.04	5.6	n.a.	38.9	Rice	55.6	3,525.66	60.6	0.0	38.0	100.0	25.0	100.0	87.5	0.0	0.0	0.0
			CYG-6	6.0	Cuyunin	3,958.75	18.8	Fish	18.8	Rice	62.5	2,101.99	45.0	0.0	50.0	100.0	12.5	75.0	100.0	0.0	0.0	25.0

Abbreviation (Code):

1. Municipality Code
   PPS : Puerto Princesa City

2. Barangay Code
   MAC: Macarascas
   BHL: Bahile
   BNV: Buenavista
   TGB: Tagbinit
   CYG: Cabayugan

(4) Condition on Mangrove Use and Other Environmental Issues

1) Implementation of Legal Systems on the Mangrove Use

On June 1992, the Republic Act 7611 was signed for the establishment of the Strategic Environment Plan (SEP) for Palawan. This Plan has set up the policy on the conservation of Palawan's environment as a precondition to any development projects, by establishment of Palawan Council for Sustainable Development (PCSD). Furthermore, the Provincial Government of Palawan has declared "Bantay Palawan" in March 1993, for the intensive control on illegal logging and illegal catch of fish in entire Palawan Province. Under such circumstance of environmental protection movement in the Province, Coastal Environment Program (CEP) is being implemented since 1993 in Ulugan Bay, and some cooperatives/corporation of beneficiaries has been organized for the contract with DENR for planting tree, research, technical training and activities for environmental protection. There is only one (1) existing 50ha fishpond for Prawn at Barangay Tagabinit in Ulugan Bay Area which is under Fishpond Lease Agreement (FLA), however, since new application for FLA has been no longer accepted after 1989, there has been no legal conversion of Mangrove forest into fishpond. There is also existing one (1) Mangrove Stewardship Agreement in Barangay Bahile, and two (2) Mangrove Reforestation Projects, 100ha each in Barangay Bahile and Macarascas in this Area.

2) Actual Condition on the Mangrove Use

Hereunder is the result of aforementioned interview survey (interviewing 200 sampled households) regarding the use condition and intention toward conservation of Mangrove. (Detailed result is shown on Table-2-4-5 in this Section, and Figure-2-1-1 to 2-1-11 in the last Section.)

a. Entering Mangrove Area

49.4% of household heads replied that they have entered Mangrove area within one year. This percentage is intermediate as compared to other 2 Study Areas (75.5% in Aparri Area, 32.5% in Lamon Bay Area). The purposes for entering is as follows:

To collect shellfish/crab	59.5%
To catch fish	4.5%

To collect woods	3.0%
To collect other plants	1.5%

b. Use Condition of Mangrove

The percentage of people who replied that they are presently using Mangrove trees, and having used mangrove trees within 3 years past is 14.7% and 15.7%, respectively. This percentage on present use, 14.7% is intermediate among three Study Areas (68.0% in Aparri Area, 12.0% in Lamon Bay Area). However, 18.2% of people replied that they had been used Mangrove trees for more than three years past, and this percentage is relatively large as compared to other two Areas (1.0% in Aparri, 6.5% in Lamon Bay Area). It might be considered that the use of Mangrove in the past in this Area was common, hence, the percentage on use has been remarkably decreased due to the intensive information activities by the governmental agency concerned on the environmental protection.

The percentage on Mangrove use by Barangay is as follows:

Name of Brgy.	Present Use	Use w/in 3 yrs. Past	Use 3 more yrs.
Bahile	6.1%	15.8%	19.4%
Macarascas	2.8%	12.5%	33.2%
Buenavista	38.9%	33.3%	11.1%
Tagabinit	20.6%	12.1%	16.0%
Cabayugan	4.2%	2.1%	8.3%

As for the purpose of use, uses as the material of fence as well as house repair are dominant. Not so many people use Mangrove as firewood (among people replied on the use of firewood, 13.7% of people answered that they are using Mangrove for this purpose). As for the method to obtain Mangrove trees, 39.3% of people is entering the Mangrove area to cut, 22.4% of people is collecting fallen tree, and 13.5% of people are buying Mangrove trees.

c. Knowledge of Use of Mangrove

As for the knowledge on what way mangrove can be utilized (regardless whether they are actually using Mangrove in that way or not), the result is as follows:

House repair	98.0%
Fuel	94.5%

Dyeing	60.5%
Make tool	49.0%
Furniture	46.5%
Make boat	35.5%
Cloth	18.5%
Food	17.5%
Net	11.5%
Paper	6.5%
Spice	4.5%
Tea	4.0%
Liquor	2.5%
Hair oil	1.5%

d. Future Intention to Use Mangrove

30.0% of households in this Area replied that they have intention to use Mangrove tree in the future. This percentage is the largest among three Study Areas (3.2% in Aparri Area, 10.8% in Lamon Bay Area). As the Area where the intensive governmental campaign on environment protection is well informed and understood by the people, it is noted that this large percentage, which is showing their intention to use in the future, may indicate the possibility on increase of cutting volume of Mangrove, in case the intensity of present information drive decreases.

For reference, percentage of people having intention to have their own fishponds was 31.5% which is the lowest in three Study Areas (49.5% in Aparri Area, 67.5% in Ulugan Bay Area).

Result by Barangays is as follows:

Name of Brgy.	Intention to use Mangrove	Intention to have Fishpond
Bahile	35.6%	35.1%
Macarascas	40.9%	46.3%
Buenavista	22.2%	11.1%
Tagabinit	19.8%	42.6%
Cabayugan	31.5%	16.7%

e. Knowledge of Legal System on Mangrove Conservation

41.5% of people in this Area replied that they have negative sense in cutting Mangrove threes (38.7% in Aparri Area, 69.8% in Lamon Bay Area). Among them, only 3.4% of people replied that laws/regulations is the reason of their negative sense. It shall be noted that people have less aware of legal restriction on Mangrove, while the intensive governmental campaign on environment protection seems as well informed well and understood by the people. 45.0% of people replied that they remember their opportunities of discussing with the Government official regarding conservation of Mangrove. This figure is remarkably large as compared to other two Areas (2.5% in Aparri Area and 26.0% in Lamon Bay Area). This figure may indicate that information activities is well informed and understood by the people, hence, also indicate necessity on the understanding of the legal regulation in the field revel. Among the people who are using Mangrove tree presently, 55.5% of people are those who do not remember such opportunity of discussion.

f. Conservation Sense of Mangrove Forest

For any kind of environmental protection movement (governmental or non-governmental), not limited on Mangrove protection in the area, 92.0% of people are aware of such movement, and this figure is the largest in three Study Areas (34.0% in Aparri Area, 72.0% in Ulugan Bay Area). Also, 96.5% of people replied that they find importance in protecting Mangrove, 93.5% of people replied their intention to positively participate on protection Mangrove actively. However, 26.4% of people answered that they grant Mangrove cutting as the way to improve their economic condition, and this percentage is not so low as compared to other two Study Areas (35.5% in Aparri Area, 11.5% in Lamon Bay Area). In consideration together with the much intention of the people to use Mangrove in the future, the present information activities by the governmental office concerned shall be maintained.

g. Benefit of Mangrove as Disaster Prevention Method

53.0% of the people in this area replied that they are benefited by Mangrove as the method of protecting their house and possession from high tide. This percentage is the largest among three Study Areas (44.5% in Aparri Area, 31.0% in Lamon Bay Area). Likewise, 57.6% of the people in this area replied that they are benefited by Mangrove as the method of protecting their house and

possession from strong wind by Typhoon.

Furthermore, among 26.4% of people who grant Mangrove cutting mentioned above, 81.9% of people replied that they are not benefited from Mangrove as natural disaster prevention method.

Table 2-2U-7 : Condition on the Use and Intention toward Mangrove Forest (Ulugan Bay Area)

CODE				ENTER/COLLECT			PRESENT USE AND METHOD					PAST / FUTURE		BENEFIT			SENSE		
Area Code	Municipality Code	Barangay Code	Sitio/Purok/Zone Code	Entering Mangrove Area in the Past Year (%)	Collecting Mangrove Trees as the Reason to Enter (%)	Having Negative Reaction to Collection of Mangrove Trees (%)	Utilization of Mangrove Trees (%)	By Cutting and Gathering (%)	By Collecting fallen trees and driftwoods (%)	By Buying (%)	Purpose of Use	Having used Mangrove Trees within Past Three(3) Years (%)	Having used mangrove Trees for more than Three (3) Years (%)	Having Intention Future Use (%)	Fish Nursery (%)	Windbreak (%)	Wave Dispersant (%)	Finding importance in maintaining Mangrove Forest (%)	Willingness to protect Mangrove Forest actively (%)	Allow Mangrove cutting as source of Livelihood (%)
U	PPS	Total		49.4	4.6	41.1	14.7	39.3	22.4	13.5	Post	15.7	18.2	30.0	78.6	57.6	53.0	96.0	93.6	26.4
U	PPS	BHL	Total	55.1	6.4	33.6	6.1	31.0	9.2	28.3	Post	15.8	19.4	35.6	77.4	58.0	51.7	100.0	100.0	13.8
			BHL-1	25.0	25.0	25.0	0.0	50.0	0.0	25.0	Post	25.0	50.0	25.0	100.0	100.0	100.0	100.0	100.0	0.0
			BHL-2	25.0	0.0	19.0	0.0	12.5	0.0	37.5	Housing	12.5	31.3	44.0	56.3	56.3	56.3	100.0	100.0	56.3
			BHL-3	85.7	0.0	71.0	42.9	14.3	14.3	85.7	Post	42.9	14.3	0.0	85.7	100.0	85.7	100.0	100.0	0.0
			BHL-4	40.0	0.0	50.0	0.0	50.0	10.0	20.0	Housing	10.0	20.0	50.0	80.0	40.0	30.0	100.0	100.0	20.0
			BHL-5	50.0	0.0	10.0	0.0	30.0	0.0	10.0	Housing	0.0	0.0	50.0	80.0	30.0	30.0	100.0	100.0	0.0
			BHL-6	60.0	0.0	0.0	0.0	60.0	20.0	0.0	Post	0.0	20.0	60.0	100.0	60.0	40.0	100.0	100.0	0.0
			BHL-7	100.0	20.0	60.0	0.0	0.0	20.0	20.0	Post	20.0	0.0	20.0	40.0	20.0	20.0	100.0	100.0	20.0
U	PPS	MAC	Total	81.8	4.4	48.8	2.8	49.7	29.9	5.6	Post	12.5	33.2	40.9	95.6	64.6	53.2	100.0	91.1	22.5
			MAC-1	87.5	0.0	0.0	0.0	100.0	62.5	0.0	Post	25.0	62.5	38.0	100.0	50.0	50.0	100.0	100.0	50.0
			MAC-2	100.0	0.0	50.0	0.0	25.0	50.0	0.0	Post	0.0	50.0	87.5	100.0	87.5	62.5	100.0	100.0	25.0
			MAC-3	100.0	16.7	50.0	16.7	50.0	16.7	0.0	Housing	0.0	16.7	17.0	83.3	50.0	50.0	100.0	83.3	0.0
			MAC-4	83.3	0.0	50.0	0.0	66.7	16.7	33.3	Post	0.0	33.3	50.0	100.0	50.0	16.7	100.0	100.0	50.0
			MAC-5	50.0	0.0	83.0	0.0	16.7	33.3	0.0	Post	50.0	16.7	33.0	100.0	100.0	100.0	100.0	83.3	0.0
			MAC-6	70.0	10.0	60.0	0.0	40.0	0.0	0.0	Rafter	0.0	20.0	20.0	90.0	50.0	40.0	100.0	80.0	10.0
U	PPS	BNV	Total	50.0	11.1	11.1	38.9	38.9	50.0	0.0	Post	33.3	11.1	22.2	55.6	44.4	44.4	100.0	100.0	55.6
			BNV-1	100.0	0.0	0.0	0.0	50.0	50.0	0.0	n.a.	0.0	0.0	50.0	100.0	100.0	100.0	100.0	100.0	100.0
			BNV-2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	n.a.	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	50.0
			BNV-3	100.0	0.0	0.0	50.0	50.0	50.0	0.0	n.a.	0.0	0.0	50.0	100.0	100.0	100.0	100.0	100.0	50.0
			BNV-4	100.0	0.0	0.0	0.0	0.0	50.0	0.0	Fuel	50.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	50.0
			BNV-5	50.0	50.0	50.0	100.0	50.0	100.0	0.0	Post	100.0	100.0	100.0	100.0	50.0	50.0	100.0	100.0	50.0
			BNV-6	0.0	0.0	0.0	50.0	50.0	0.0	0.0	Post	0.0	0.0	0.0	50.0	0.0	0.0	100.0	100.0	50.0
			BNV-7	0.0	0.0	0.0	50.0	50.0	50.0	0.0	Fuel	50.0	0.0	0.0	50.0	50.0	50.0	100.0	100.0	50.0
			BNV-8	0.0	50.0	0.0	100.0	50.0	100.0	0.0	Post	0.0	0.0	0.0	50.0	50.0	50.0	100.0	100.0	100.0
			BNV-9	0.0	0.0	50.0	0.0	50.0	50.0	0.0	Housing	100.0	0.0	0.0	50.0	50.0	50.0	100.0	100.0	0.0
U	PPS	TGB	Total	21.7	0.0	36.7	20.6	53.2	21.5	7.9	Post	12.1	16.0	19.8	64.1	57.2	57.2	100.0	97.6	23.5
			TGB-1	14.3	0.0	71.0	57.1	85.7	0.0	0.0	Post	14.3	0.0	14.0	100.0	100.0	100.0	100.0	85.7	28.6
			TGB-2	28.6	0.0	29.0	0.0	0.0	0.0	14.3	n.a.	0.0	0.0	14.0	42.9	14.3	14.3	100.0	100.0	0.0
			TGB-3	87.5	0.0	0.0	0.0	100.0	62.5	0.0	Post	25.0	62.5	38.0	75.0	62.5	62.5	100.0	100.0	12.5
			TGB-4	0.0	0.0	67.0	0.0	0.0	33.3	0.0	Post	0.0	33.3	0.0	33.3	33.3	33.3	100.0	66.7	33.3
			TGB-5	0.0	0.0	20.0	0.0	33.3	0.0	33.3	Housing	33.3	0.0	20.0	33.3	33.3	33.3	100.0	133.3	66.7
			TGB-6	0.0	0.0	33.0	66.7	100.0	33.3	0.0	Post	0.0	0.0	33.0	100.0	100.0	100.0	100.0	100.0	0.0

U	PPS	TGB	Total	21.7	0.0	36.7	20.6	53.2	21.5	7.9	Post	12.1	16.0	19.8	64.1	57.2	57.2	100.0	97.6	23.5
			TGB-1	14.3	0.0	71.0	57.1	85.7	0.0	0.0	Post	14.3	0.0	14.0	100.0	100.0	100.0	100.0	85.7	28.6
			TGB-2	28.6	0.0	29.0	0.0	0.0	0.0	14.3	n.a.	0.0	0.0	14.0	42.9	14.3	14.3	100.0	100.0	0.0
			TGB-3	87.5	0.0	0.0	0.0	100.0	62.5	0.0	Post	25.0	62.5	38.0	75.0	62.5	62.5	100.0	100.0	12.5
			TGB-4	0.0	0.0	67.0	0.0	0.0	33.3	0.0	Post	0.0	33.3	0.0	33.3	33.3	33.3	100.0	66.7	33.3
			TGB-5	0.0	0.0	20.0	0.0	33.3	0.0	33.3	Housing	33.3	0.0	20.0	33.3	33.3	33.3	100.0	133.3	66.7
			TGB-6	0.0	0.0	33.0	66.7	100.0	33.3	0.0	Post	0.0	0.0	33.0	100.0	100.0	100.0	100.0	100.0	0.0
U	PPS	CYG	Total	29.2	0.0	75.3	4.2	18.8	0.0	20.8	Post	2.1	8.3	31.5	87.5	54.2	50.0	80.00	62.5	14.6
			CYG-1	0.0	0.0	63.0	12.5	25.0	0.0	37.5	Trusses	0.0	25.0	38.0	100.0	87.5	75.0	100.0	75.0	12.5
			CYG-2	0.0	0.0	88.0	0.0	25.0	0.0	0.0	Post	0.0	0.0	25.0	75.0	37.5	37.5	75.0	62.5	25.0
			CYG-3	50.0	0.0	63.0	0.0	0.0	0.0	25.0	Housing	0.0	0.0	25.0	87.5	62.5	62.5	62.5	50.0	25.0
			CYG-4	25.0	0.0	75.0	0.0	0.0	0.0	37.5	Housing	0.0	0.0	63.0	100.0	62.5	62.5	62.5	50.0	12.5
			CYG-5	50.0	0.0	88.0	0.0	12.5	0.0	12.5	Post	0.0	12.5	13.0	75.0	25.0	12.5	100.0	62.5	0.0
			CYG-6	50.0	0.0	75.0	12.5	50.0	0.0	12.5	Housing	12.5	12.5	25.0	87.5	50.0	50.0	100.0	75.0	12.5

Abbreviation (Code):

1. Municipality Code
   PPS : Puerto Princesa City

2. Barangay Code
   MAC: Macarascas
   BHL: Bahile
   BNV: Buenavista
   TGB: Tagbinit
   CYG: Cabayugan

Bibliography (II-2-3)

1_/ PAGASA 1998 Meteorological data in Aparri

2_/ Bureau of Mines in coordination with the Board of Technical Surveys and Maps 1963 Geological Map Series NC-52

3_/ PAGASA 1998 Meteorological data of Alabat, Quezon

4_/ PAGASA, Climatology & Agrometeorology Branch 1998 Information on Tropical Cyclone 1948-1996

5_/ Bureau of Mines in coordination with the Board of Technical Surveys and Maps 1963 Geological Map Series NF-51

6_/ PAGASA 1998 Meteorological data in Pueruto Princesa

7_/ Bureau of Mines in coordination with the Board of Technical Surveys and Maps (1963) Geological Map Series NC-50

Provincial Government of Cagayan 1995, Provincial Profile, Cagayan Province,

Provincial Government of Cagayan 1998, Socio-economic Profile, PPDO,

National Statistic Office 1996 Census of Population & Housing Report No. 3-21B: Socio-Economic and Demographic Characteristics, Cagayan Province,

National Statistic Office 1996 Census of Population & Housing Report No.2: Population by City, Municipalities & Barangay, Cagayan Province,

Provincial Government of Cagayan 1994 Regional Physical Framework Plan 1993-2022, Region II, Cagayan Valley, 1995 Census of Population - Cagayan Valley, NSO

National Statistic Office 1995 Census of Population - Southern Luzon,

NEDA 1990 Regional Development Plan Update 1990-1992 Central Luzon Region,

NEDA 1993 Southern Tagalog Regional Development Plan, 1993-1998,

NEDA The Luzon Areas Development Framework and Strategic Investment Program

National Statistic Office 1990 Census of Population and Housing Report No. 3-70D: Socio-Economic & Demographic Characteristics, Quezon Province

National Statistic Office 1990 Census of Population and Housing Report No. 2-80D: Population by City, Municipality and Barangay, Quezon Province, NSO

Provincial Government of Quezon Provincial Profiles, Quezon Province,

Municipality of Calauag, Quezon 1985-2000 Comprehensive Development Plan,

National Statistic Office, Census of Agriculture, Province of Quezon, NSO

Provincial Government of Quezon Provincial Profiles:Province of Quezon, 1996,

National Statistic Office 1990 Census of Population and Housing Report No.3-67 D: Socio-Economic and Demographic Characteristics, Palawan, NSO

Palawan, Office of the President The Aquino Administration Major Development Program & Projects 1986-1992,

Provincial Government of Palawan 1996 Provincial Socio-economic Profile, PPDO,

III Observation and Recommendation

1 Key points for Mangrove Conservation Planning

1-1 Mangrove use and Conservation

Mangrove forests have been utilised in various manners by seashore villagers for many years. These products are still important in supporting the common daily life of the villagers. To formulate mangrove forest management planning, the planner has to keep in mind how to control the uses of the villagers

1-1-1 Common Uses of Mangrove

There are various ways to use mangrove forests that are not limited to timber, firewood and other wood-related uses and by-products such as tannins including coastal fishery and marine farming of prawns, crabs and oysters. Although the value of mangroves as a timber resource cannot be currently appreciated to the full in the Philippines, they still often provide coastal fishermen with a source of livelihood. The maintenance and conservation of the mangrove ecosystem is essential to preserve coastal fisheries in view of sustainable use of fish resources. In this section, a general view of mangrove resources is taken citing extracts from the FAO Report (Environment Paper 3 1_/) that concisely describes how they have been used.

(1) Timber and Charcoal

Under favorable conditions, the *Rhizophora* species may exceed 40 m but the trees are usually cut down before that height. Furthermore, *Rhizophora* spp. has little value as timber and only sizeable mangrove forests are managed for commercial timber production. A number of other species are used locally in many countries. Sizeable *Sonneratia alba* have been commonly used for house construction. Therefore along Lamon bay, the remaining stumps of large *S. alba* can be found.

Rhizopohora spp makes excellent quality charcoal. Other mangrove species (*B. gymnorrhiza* and *Ceriops* spp) are also used but are quantitatively less important.

It is mainly used for cooking purposes. Mangrove charcoal is made on a commercial scale in large ovens (100 - 200 m3), which may be used over 40 years if regularly worked and maintained.

Mangrove species are used as firewood of which *Rhizophora* spp is a popular source. The wood is heavy and burns with high heat, little smoke and is easy to light. *Xylocarpus* spp burns very fast but with not such a high heat. *Avicennia* spp is a light wood with low calorific value but has a clean white smoke which is suitable for smoking fish.

(2) Tannin

Tannins are used for leather, inks, plastics. *Ceriops* spp. yield the best quality tannins for leather production, but most mangrove species contain tannins. Mangrove tannins are still used locally for leather and for the preservation of fishing nets. Nevertheless, these days tannin is not recognized as an important product due to the introduction of synthetic fishing nets and the development of other sources such as wattle bark (Acacia spp).

(3) Pulp

Sulphate pulps with relatively strong properties can be produced from *Camptostemon schultzii, Sonneratia caseolaris, Excoecaria agallocha* and *A. marina*. *Rhizophor* spp and *B. gymnorrhiza* are not used for long fiber pulp.

(4) Other Uses

Various parts of mangrove plants may be eaten. The fruits of *Avicennia* spp, *Sonneratia* spp and *Heritiera* spp are edible as are the seedlings. *Avicennia* spp. young roots *of Bruguiera* can be eaten and the leaves of *Sonneratia* used in salad. The foliage of some species may be used as fodder for cattle.

Honey and bees wax is collected from *Exocecaria, Avicennia, Aegiceras* and other mangrove species. Oil extracted from Cerbera seeds can be used for medicine, and *Xylocarpus* seeds are used for incense and hairdressing.

(5) Nipa

The nipa palm is a very useful plant. The lower surface of young leaves is used for cigarette wrappers, while older leaves are used extensively as thatch. The leaves may also serve as a potential new material for high-string papers. The flowers can be tapped for sugar, alcohol or vinegar production. This was once a major industry in the Philippines.

The main use of each mangrove species is shown in table 3-1 below. 2_/

Table 3-1 Main Mangrove Uses

Species	Uses
Aegicera corniculatum (L) Bianco	firewood, beams, poles (building). fish poison. paper (various kinds), honey
Avicennia alba Blume	firewood, beams. poles (building). fence posts. pipes. chipboard, glue, wood for smoking fish, fish poison. paper (various kinds) Fodder, green manure, sweetmeats/ propagules, medicines
A. mariana Vierh	firewood, heavy construction, beams, poles (building), wood for smoking fish. paper (various kinds), fodder, green manure, vegetables honey, soap
Avicennia officinalis	firewood, wood for smoking fish, paper (various kinds), redder, green manure, vegetables, rice mortar
Bruguiera cylindrica. (L)Blume	firewood, charcoal, timber, scaffolding, mining pit props, beams, poles (building), poles for fish traps, tannins for leather, rituals
B.gymnorhiza (L) Lam	firewood, charcoal, timber, scaffolds, heavy construction mining pit props, boat building, beams, poles (building), fence posts, pipes, chipboard, glue, wood for smoking fish, tannins/net preservatives, tannins for leather, condiments from bark, vegetables, medicines, furniture, tool handles
B. parviflora. (Roxb.) Wight and Arn	firewood, charcoal, timber, scaffolds, mining pit props, beams, poles (building), tannins for leather, paper (various kinds)
B. sexangula. (Lour.) Poiret	firewood, charcoal, timber, scaffolds, beams, poles (building), tannins for leather, condiments from bark, vegetables, medicines, chewing gum, incense
Ceriops tagal (Perrottet) Robinson	firewood, timber, scaffolds, mining pit props, boat building, beams, poles (building), tannins/net preservatives, dye for cloth, tannins for leather, paper (various kinds), tea substitutes, medicines
Excoecaria agallocha L	timber, scaffolds, flooring, panelling, floats, fish poison, paper (various kinds), packing boxes, condiments from bark, honey, toys, matchsticks, incense
Heritiera littoralis Aiton ex Dryander	Firewood, timber scaffolds, heavy construction, railroad ties, boat building, dock pilings, beams, poles (building), flooring, panelling, fence posts, pipes, chipboard, glue, tannins/net preservatives, furniture, tool handles, rice mortar

Lumnitzera littorea (Jack) Voigt	firewood, heavy construction, railroad ties, mining pit props. boat building, dock pilings, beams, poles (building), flooring, panelling, fence posts, pipes, chipboard, glue, poles for fish traps, wood for smoking fish, furniture, tool handles
Nypa fruticans van Wurmb	fuel alcohol, thatch, matting, poles for fish traps, floats, raincoats, umbrellas, hats, sugar, vinegar, fermented drinks, sweetmeats/ propagules, cigarette wrappers, medicines, baskets
Rhizophora apiculata Blume	Firewood, charcoal, timber, scaffolds, heavy construction, railroad ties, mining pit props, dock pilings, beams, poles (building), fence posts, pipes, chipboard, glue, poles for fish trails, furniture, Christmas trees
Rhizophora mucronata Lam	Firewood, charcoal, timber, scaffolds, heavy construction, railroad ties, mining pit props, dock pilings, beams, poles (building), fence posts, pipes, chipboard, glue, poles for fish traps, tannins for leather, paper (various kinds), fodder, green manure, fermented drinks, sweetmeats/ propagules, honey medicines, furniture, Christmas trees
Sonneratia alba Smith	Firewood, heavy construction, boat building, dock pilings, beams. poles (building), flooring, panelling, fence post, pipes, chipboard, glue, poles lot fish traps, floats, textile dye, fodder, green manure, vinegar, sweetmeat/propagules, vegetables, furniture
Sonneratia caseolaris (L) Engl	firewood, timber, scaffolds, heavy construction, railroad ties, boat building, dock pilings, beams, poles (building), flooring, panelling, fence posts, pipes, chipboard, glue, pallets, floats, paper (various kinds), redder, green manure, sweetmeats/propagules, furniture, cosmetics
Xylocarpus granatum Koxnig	firewood, timber scaffolds, railroad ties, boat building, dock pilings, beams, poles (building), flooring, panelling, fence posts, pipes, chipboard, glue, textile dye, paper (various kinds), furniture, tool handles, toys, woodware, carvings, pencils

Source: 2_/

1-1-2 Mangrove Plantation

A recent report on mangrove plantations.(Bernardo Dumlao Agaloos 1994) indicated that of the preliminary attempts on afforestation that are reported, the largest trial by a Government is the Sulu Mangrove Afforestation Project covering an area of 4,636.4 ha in the nine islands of Jolo Sulu in Region 1X. Initial implementation was in the Marungas Island of Sulu in 1981. The project involved the active participation of the villagers living in the project areas. Initial implementation planted the species *R. apiculata, B. cylindrica, B. parviflora, B. sexangula, A. officinalis and C. tagal.* In Banacon Island of Bohol province, about 150 ha of coastal areas were planted with *R. apiculata* and *R.styrosa*, starting in 1966. Thereafter, in several areas of Cebu province, about 190 ha. were planted. In 1984, funded by the World bank, work began on afforestation of an area covering 200 km of coastline,

about 200,00 ha, on Cebu, Negros Oriental, Siquijor, and Northern Bohol." 3_/

Mangrove plantations in the Philippines occupy smaller areas but are widely spread, and involve many local NGOs. Nevertheless, most projects involve limited small scale planting of *Rhizophora* species on tidal flats from direct seeding. Table 3-3, shows possible planting species and suitable locations. 3_/ The expected rehabilitating sites are not limit planting to tidal mud flat areas, where the *Rhizophora* species is suitable. In middle intertidal zone and high intertidal zone where many mangrove species other than *Rhizophora* species are common, therefore, planting species diversification may be required. The Philippines, of course, have experience to plant many species other than *Rhizophora*. However thise knowledge and experience is not well distributed in other mangrove areas.

At present, there are wide areas of mangrove requiring re-afforestation or rehabilitation such as open mudflats, exposed sandy beaches, mine tailing areas, and de-graduated mangrove areas and abandoned former fishpond areas.

The present Government policy on re-afforestation activities of Mangrove areas is to promote re-afforestation in the following five priority areas.

Priority 1. Inadequately stocked over logged areas, idle and abandoned fishpond and salt-beds, denuded and open areas inside the mangrove swamp, Wilderness Areas and Mangrove Swamp Forest Reserves.

Priority 2. Mangrove areas adjacent or nearby the red-tide affected coastal areas.

Priority 3. Mangrove areas in the typhoon belt or stormy surge regions such as in Bicol, Western Pangasinan, Samar and Leyte, Batanes, Bataan and Eastern Mindanao.

Priority 4. Mangrove areas, including the adjacent mudflats and tidal flats with conservation potential as habitat, foraging and resting sites of aquatic and terrestrial fauna including amphibians and wildlife.

Priority 5. Mangrove areas including mudflats and tidal flats outside the areas stated above.

The reforestation activities have centered on Priority 1 areas. Physical targets of the mangrove re-afforestation under the Philippines Master Plan for Forestry

Development (1990) is 4,860 ha per / year (including nipa plantation, and on abandoned fishponds converted to plantations) shown on Table 3-2.

Table 3-2 Mangrove Re-afforestation Plan(1990)

(Unit ha)

Targets	1991-95	96-2000	2001-05	2006-10	2011-15	Total
Mangrove plantation	19,000	25,000	25,000	25,000	25,000	119,000
Nipa plantation	500	500	500	500	500	2,500
Abandoned fishpond	5,000	5,000	5,000	5,000	5,000	40,000

.

Table 3-3 Zoning of Mangroves and Species to be Planted

Zone	Tidal inundation regime	Soil types	Common mangrove species occurring naturally	Species to be planted
Seaward	Daily, including neap tides	Coral rubble, sandy,	*Avicennia marina; Sonneratia alba; S. caseolaris; Rhizophora stylosa; R. apiculata*	*Rhizophora stylosa* (coral rubble or sand) R.apiculata
Middle	Daily, except during neap tides	Silty to silty clay	*Avicennia alba* *Avicennia officinalis* *Rhizophora apiculata* *R. mucronata* *Aegiceras floridum* *A. corniculatum* *Bruguiera cylindrica.* *B. parviflora.* *B. gymnorrhiza.* *B. sexangula.* *Ceriops tagal* *C. decandra* *Excoecaria agallocha* *Lumnitzera racemosa* *Xylocarpus moluccensis*	*Rhizophora apiculata* (sandy loam, silty) *Rhizophora mucronata* (silty clay) *Ceriops tagal* (silty to silty clay)
Landward	inundated only during spring tides	Silty to silty clay	*Avicennia alba* *Bruguiera sexangula.* *Ceriops tagal* *Excoecaria agallocha* *Heritiera littoralis* *Xylocarpus granatum* *X. moluccensis* *Nypa fruticans*	*Ceriops tagal* (silty to silty clay) *Nypa fruticans* (silty to silty clay & only where there is freshwater intrusion)
Riverine subdivided river-mouth and upstream forebank and back bank	Variable inundation, brackish/freshwater influenced	Silty to silty clay to clay	**Rivermouth** *Avicennia marina* *A. officinalis* *Aegiceras floridum* *Aegiceras corniculatum* *Rhizophora apiculata* *R. mucronata* *R. stylosa* **Upstream** *Avicennia alba* *A. officinalis* *Aegiceras floridum* *A. corniculatum*	*Rhizophora stylosa* (sandy, rivermouth) *R. apiculata* (silty to silty clay, rivermouth and upstream backbank) *R. mucronata* (silty to silty clay, rivermouth and

			Bruguiera cylindrica. *B. gymnorrhiza.* *B. parviflora.* *Excoecaria agallocha* *Heritiera littoralis* *Rhizophora mucronata* *R. apiculata* *Xylocarpus granatum*	upstream forebank) *Nypa fruticans* (silty to silty clay, brackish water)

1-1-3 Marine Fishery and Fishpond

(1) Food-web

Mangrove ecosystems support marine fisheries by serving as a nursery and as a feeding ground for many marine species and by producing large amounts of confusion for the marine food-web. Mangrove forests serve as a link between terrestrial and marine ecosystems. There is generally an import source of organic nutrients from inland to the mangrove and an export of organic matter from the mangrove to the sea. In addition, within the surrounding environment, there are valuable small-scale fisheries for local seaside villages. Mangroves also support food production by acting as shelterbelts.

Many species of commercially important marine organisms depend on mangroves for at least part of their life cycle. Many species of penaeidea shrimps spawn off-shore using mangroves as a refuge and feeding ground during the later stages. If the mangrove forest is removed from the estuarine ecosystem, such species will disappear from the area "Mangrove-dependent" species only demand a muddy bottom and a certain saline conditions typically associated with mangrove environments and therefore might persist even after the destruction of the mangrove vegetation. Penaeus indicus, P. merguiensis and P. monodon depend on mangrove forests for shelter during their juvenile stages, that P. semisulcatus live as juveniles in sea-grass beds, that P. japonicus is mangrove-intolerant and, finally, that most species of Metapenaeus depend on mangrove creeks, back-waters and lagoons but might persist even after the destruction of the mangrove vegetation. 5_/

(2) Fishpond

Brackish water aqua-culture ponds occupy the largest part surrounding mangrove areas. Fishpond construction is one of the primary causes of decreasing mangrove forests all around the world. Nevertheless, regarding the rural economy, fish or shrimp farming can not be ignored in the efforts to conserve mangrove forests.

Brackish water ponds are constructed on sheltered areas in mangrove forest, especially in low bush and scrub areas. After the mangrove trees are cut, dikes are built around the area. After two or three years, the roots are removed.

Small scale fishponds are mostly used for shrimp and milkfish. Milkfish fry is common in mangroves and coastal waters. The fry are caught after the post-larval stage and before the fingerling or late fry stage.

In 1993, more than 600,000 m tons of shrimp were harvested from around 960,000ha of ponds world wide. Shrimp farming has grown up rapidly. Production of crustaceans by various forms of aquaculture increased by nearly 325% to nearly 1 million tons between 1984 and 1992. In 1992, 90% (884,000 t) of this production was marine shrimp. 5_/.

The fishpond is suitable on clay, sandy clay, sandy loam or silt loan. Rocky, sandy, and heavy root-ridden soil with poor water retention capability is avoided. The productivity of brackish water pond is low on acid sulphite soils and heavy inputs of lime.

To construct a fishpond, it is essential to maintain a minimum depth of water in a pond during the rearing tidal level and the elevation of the prospective pond site is important. Ideal pond sites are those which do not require too much excavation or filling in and do not need pumping.

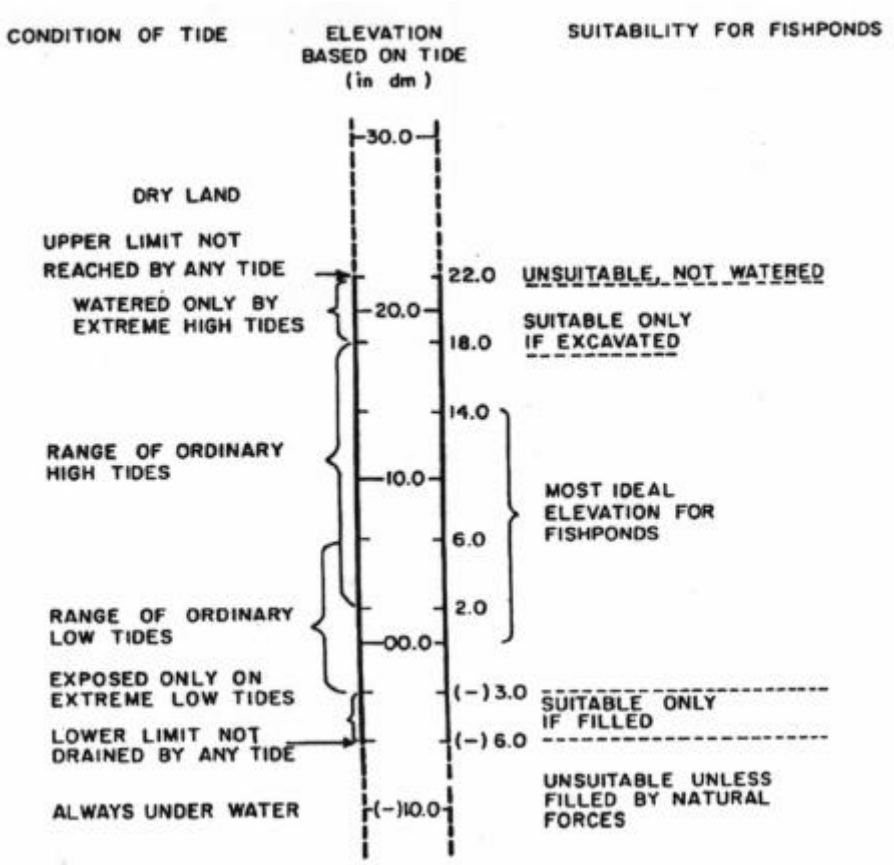


Fig. 3-1 Suitable Mangrove Sites for Fishponds

Figure 3-1 shows suitable sites for fishpond construction based on the Philippine experience. (Rabanal,1977) 6_/ Following Rabanal's suggestion, a suitable location is not along the seaside *R. apiculata* forest area but the near high inter-tidal area, 1 to 1.5 m higher than the normal low tide level. It is not suitable to excavate deeper in order to avoid causing sulphite acid soil contamination, restricting the approach inland. While small ponds by local villagers were constructed near the sea since the removal of mangrove roots is easier than inland areas, recent fish pond construction techniques involve heavy equipment and an increase in scale. Based on the latest economies of scale in shrimp farming, fishpond areas have moved from seaside *R. apiculata* forest areas to *H. littoralis* and bush areas, being more friendly to the mangrove ecosystem and coastal fisheries.

There are many abandoned or deteriorating fishponds all around the world, and within the survey areas of the Philippines, environmental problems have also

arisen. Main causes of abandonment of fishponds are disease, acid sulphate soil, natural disasters and management failure.

From unofficial estimates, fishponds left idle after a production period can be as high as 70%. In Thailand (and probably elsewhere), these are subsequently converted to other uses, such as redevelopment into factories or housing estates (Macintosh 1996).

Disease has been widely cited as a cause of production failure, and the shrimp industry has seen the development of a variety of diseases which have spread from one shrimp farming nation to another. The problems were the result of a variety of pathogens including viral, bacterial and protozoan infections as opposed to the occurrence of one single disease. Monodon Baculovirus (MBV), Yellow Head Baculovirus (YHDBV), white spot disease are typically reported in all countries.

The development of acid sulphate soils has been cited as either a direct or indirect cause of production failure. In many places, mangrove soils exist as 'potential acid sulphate soils', and as a result of the excavation and construction of shrimp ponds the soil may become actual acid sulphate soils. Upon wetting, these soils release large quantities of acid into the pond water together with toxic levels of iron and aluminium, which are directly responsible for fish and prawn losses and general low productivity.

Other reasons separate from the technical aspect affecting the continuation of pond management include low shrimp prices, mismanagement, licensing problems and other political and financial failures. 5_/

1-2 Recommendations

The current state and use of mangrove forests in the study area have already been reviewed including fishponds linked to their existence. Based on this information, the Philippine side will formulate the Mangrove Conservation and Management Plan. The survey team's view to this management plan formulating by the Philippines will be discussed in the following.

(1) Definition of the Mangrove Forest on the Land Use Demarcation Plan

a. It is necessary to instil common understanding concerning the extent of mangrove forests covered by conservation plans. It is appropriate to define mangrove forests as areas covered by sea water at the time of spring high tide, not as areas covered by distinguishable mangrove species such as *Rhizophora*.

b. It is necessary to limit governmental support to facilitate fishpond rehabilitation or recovering except the fishpond located in upper middle to lower high inter-tidal zone. As for fish ponds in low inter-tidal zones, land use plans should basically consider the possibility of restoring them to mangrove forests, except for those used for small holders of the seaside villagers.local residents.

The first difficulties in formulating the management plan is to specify the area of coverage. Mangrove forests were once wildernesses which belonged to nobody. Today, however, many people wish to convert these forests into fishponds if they have the opportunity and funding. The few mangrove forests which remain will rapidly disappear unless central and local administrative agencies together with the support of the local people take full control over such conversion.

On the other hand, it is also the role of the agencies to support local communities ,including coastal fishermen, in their livelihoods and economic development since the existence of fishponds can not be completely denied. Accordingly, the Mangrove Conservation and Management Plan aiming at the protection and conservation of mangrove forests and also their reforestation ,if possible, will be inevitably followed by discussions between forest management and industrial development departments relating to environmental conservation.

In this respect, co-operation and co-ordination among relevant agencies is the most important factor. Their co-ordination will be inevitably affected to a significant extent by the political power of these agencies. Nevertheless, it is fundamental that the plan must represent rational reasons for co-ordination based on economic and natural conditions. Demarcations which may limit land use must

also be easily understood by the local people.

The mangrove forests which the Conservation and Management Plan will cover can be represented in simple terms, by the remaining mangrove forests together with the land to be reforested, and less the area allowable for conversion. In the present state, a land use plan is officially required to classify and express areas as Forests Land, A and D on the unified map. This demarcation has been actually operated by administrative agencies in different ways: an area which forest departments consider under their jurisdiction sometimes overlaps with an area outlined by the fisheries departments in the fields. There is such a confused situation that despite being awareness on the important mangrove areas for protection from the standpoint of a government agency, development is going on with the official approval of another agency.

This situation is mainly attributable to the disparity between the demarcation on the map under the land use plan and the real expanse of mangrove forests. The limited precision of the map is one of the factor in disparity. The absence of a land use map drawn on a large scale which can represent minute topographical features inevitably confuses the field staff.

The second factor is that Barangay boundaries are not indicated on topographic ways and therefore third parties have no way to know which agency has or does not have the jurisdiction to allow on permit land development different from the present land use. Opaque co-ordination of directly interested parties with other stakeholders directly leads to the approval of competent authorities. As a result, departments responsible for mangrove conservation are driven into a less advantageous position.

The third factor is that the accurate boundary of mangrove forest is not shown on an accurate map and therefore the conversion of mangrove forests under conservation is permitted on the assumption that they are outside the reserved areas. There is also a delicate gap in the definition and perception of mangrove forests among relevant agencies. This seems to obstruct proper administrative judgement according to accurate information of the current circumstances. The gap in the perception of mangrove forests and lack of revised situation on map

information may lead different views, between the field staff and senior officers or among relevant agencies consequently makes it difficult to regulate the local development of fishponds.

In the land use plan, fishery-related administrative agencies do not oppose the protection of mangrove forests but concentrate on their conservation and sustainable use. Also, 98% of people interviewed by the socio-economic survey understand the necessity for protecting mangrove forests. However, it cannot be said that they have common knowledge as to which areas should be protected. It is natural for people to think that certain areas are not part of the forest or that it would be acceptable to fell a small part of such a large *Rhizophora* forest. In the case of inland mangrove forests, a line cannot be clearly drawn between real mangroves and shrubs. In the land use plan, boundaries are drawn and in many cases on bushy mangrove areas. On other view, the remaining mangrove forests are limited to some areas; nevertheless, villagers living in surrounded mangrove forest neither plants nor vegetation in the forests are considered rare by the local people because they see much mangrove stands very common.

To demarcate mangrove conservation areas in the land use plan, the remaining mangrove forests should be identified as the first step. It is relatively easy to distinguish mangrove forests whose species form relatively large crowns and can be recognised as dense growths on aerial photos, such as *A. officinalis* and *H. littoralis*. Nevertheless, their inland fringe cannot be easily distinguished. However, from a practical point of view, the mangrove zone should be defined as an area extending from the coastal area to the high inter-tidal area submerged during the spring high tide even if the areas are looked almost bush. A conservation and reforestation plan should cover these areas. Many fishponds have been already constructed in the zone or received permission and approval from different administrative agencies.

Regardless of the percentage of generally recognised real mangrove species in forests, it would be understandable to most people if the fore-mentioned remaining mangrove forest is defined as an area which forms a forest or a swampy grassland as far as the area is submerged during the spring high tide. This definition would enable the field staff to locate such an area without opposition.

The next problem is how to specify areas which will be provided for permitable land use in the future. The recent change and use of mangrove forests concentrate on the development of fishponds. As previously stated, the most suitable site for developing a fishpond is a zone 1 m to 1.5 m above the usual low-tide level. In terms of vegetation, this condition is not satisfied by suitable zones for *Rhizophora* and *Bruguiera* and zones dominated by low trees of *C. tagal* and *A. officinalis*. Instead, it is satisfied by zones dominated by *H. littoralis*, *S. hydrophyllacea*, and *X. granatum*. Moreover, areas near the upper limit of the mangroves are likely to expose acid sulfate soil, which is unsuitable. In fact, stands of bushy *E. agallocha* in the high inter-tidal zone remain intact even in the Kabibihan, and Makahadok Zone Lamon Bay area where many fishponds have been developed. Relatively large trees which stand in these suitable fishponds zones have roots which are not easy to cut and remove. That is why small traditional fishponds have not been developed there. However, it is reported that modern fishpond development has shifted to high-inter tidal zones in Thailand and Malaysia.

Accordingly, it would be advisable to permit and approve fishpond renewal or rationalise limited to zones which are dominated by middle to high-intertidal mangrove species such as *S. hydrophyllacea, H. littoralis, and E. agallocha* are growing, and promote the conservation and restoration of mangrove forests in this area in parallel with fishpond renewal work so that over 50% of the forests will be maintained or rehabilitate in the future. These zones can be defined as zones under the joint control of fishery development agencies and the environment and forest-related agencies. Specific demarcation on the map will be enabled using the Mangrove Forest Type Map prepared in this study. Boundaries can be clearly determined from vegetation at the site. Even if any fishpond is developed without approval, it will be possible to determine whether the site is to be approved or not. It will also be made clear whether the ongoing development has complied with permission or not or whether permission has created any problem or not. Consequently the transparency of administrative decisions will be improved.

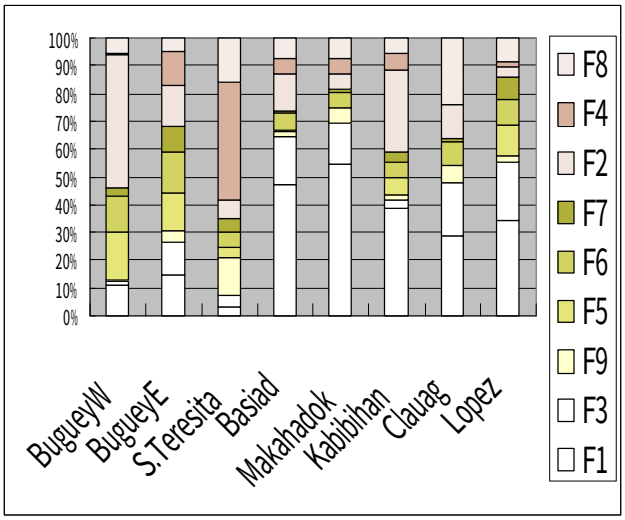
The third issue is to specify land for mangrove reforestation. Currently, many fishponds exist even in low inter-tidal and middle inter-tidal zone. However, it is not realistic to prohibit the use of these fishponds and compulsory convert them into mangrove forests. According to the results of the socio-economic survey, many

medium size fishponds are owned and managed by outside enterprises from which local villagers directly receive limited benefit. However, it is notable that a considerable number of small traditional fishponds are directly managed by villagers. In this regard, it is advisable to promote substantiable land use which will contribute to both the restoration of the mangrove environment and fish culture by maintaining the productivity of fishponds and facilitating coastal fisheries while encouraging the owners of less productive fishponds to gradually plant mangrove species in up to 50% of the area.

Areas which will be covered by the mangrove reforestation plan are found on unused fishponds. Study revealed, that many very large fishponds were abandoned. Figure 3-2 shows the area of fishponds by type in Buguey West and Buguey East zones in the Aparri area, Basiad, Makahadok, Kabibihan, Calauag and Lopez zones in the Lamon Bay area where fishponds occupy a large area compared with other zones in the study area.

The total area of fishponds under Type F8 which are probably unused and fishponds under Types F4 and F2 which are probably seldom used accounts for 36% of the total area of all fishponds. It is not practical to leave them as they are. If they are not available for fish farming from an economic point of view, mangrove plantation on these areas have to be implemented, while it is not easy to solve land use right or ownership right.

Many abandoned fishponds owned by outsiders who may not the original fishpond developer; therefore, a guide lines to be formulated to make sure about the procedures to returned the less used fishponds to the government authorities and to allocate the areas for local villagers group to be rehabilitate mangrove ecosystem and sustainable use. These abandoned fishponds are increasingly regarded as a serious problem all over the world. Implementing measures for these sites will become an important task in the Mangrove Conservation Plan.



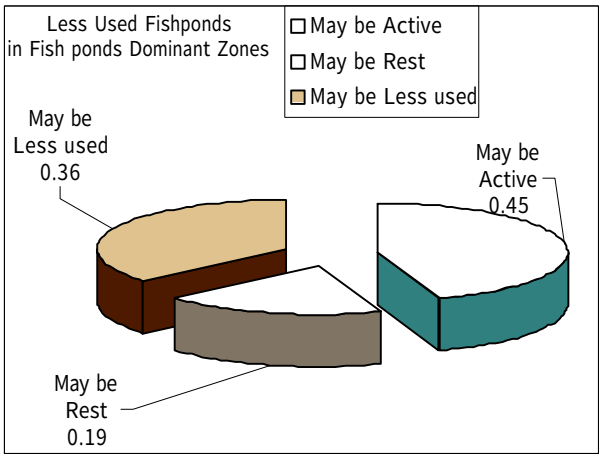


Fig. 3-2 Condition of Fishponds Occupying Large Areas.

Although there are probably various causes for abandonment, the shift of fishpond development to other mangrove forest areas should be avoided by all means. In this respect, planning the total conversion of all the abandoned fishponds into mangrove forests is not only unrealistic but also likely to induce the shift of fishpond development. Policies should be focused in support for revitalising fish culture in this area. A suitable waterway system is indispensable for managing fishponds in this area. Accordingly, it would be advisable to support revitalise fish farming. The government authorities should apply guidelines to follow strictly. Mangrove species shall be planted on both sides of waterways. Then the planner can makes target to rehabilitate mangrove forest at approximately 30% of the total area of the existing fishpond zone.

(2) Supply of Mangrove Woods

Under mangrove forest management plans, it is difficult to conceive supplying mangrove lumber on a commercial basis. However, supply for seaside villagers for fuel use should be considered. For the conservation of mangrove forests, the planners should consider how to supply substitute lumber/fuel wood with afforestation activities on other mangrove forest areas as well, so as to reduce the degree of dependence on mangrove forests.

The use of mangroves has been described in the preceding section. Log supply

is expected as the core of mangrove forest management plans in many countries. The management system of mangroves in Malaysia's Matan region is famous for sustainable timber production. In the Philippines, however, it is not very realistic to expect the sustainable supply of building materials and industrial firewood. At least in the study area, there is no sizeable mangrove forest in terms of sustainable timber production and growing stock. The only original forest in Ulugan Bay consists of trees 20-30 cm in diameter and 20-24 m in height and has a growing stock of 200 m3 per ha. However, its total area is not more than 100 ha. If the growth period and sustainable production are taken into account, the harvested area will be no more than 2-3 ha, and the annual yielding will be no more than 600 m3. This volume of logs 300 to 400 m3 (at using late of 50% to 70%) is only equivalent to the quantity of wood required to charge two times for a commercial charcoal kilns and falls short of the required charcoal output for export.

Mangrove timber is still often used as firewood, fences and house-repairing materials in agricultural and fishery villages along the coast. Trees cut for these purposes were observed in every mangrove forest. Young trees 6-8 cm in diameter are cut in large quantities for firewood and fences especially in the Lamon Bay area. It was also revealed in the socio-economic survey that firewood is frequently collected even in the Aparri area where real mangrove forests are limited.

The Mangrove Conservation Plan also needs to give consideration to the small-scale traditional use of mangrove timber as firewood by the local people. It would be impractical for the DENR to prohibit and regulate the collection of firewood by legal means. A measure to limit the collection at a certain level is indispensable for the plan. Such a measure should be considered from two points of view: one is to give an alternative source of firewood which will replace mangroves; and the other is to build a system for a certain level of mangrove use.

Since mangrove timber is mostly used as firewood and fences, a solution to the first problem is to give access to the creation of firewood forests in the land area, especially on the floor of coconut forests. That is to promote agricultural forestry which will create a new source of income. Coconut forests rather than paddies extend around mangrove forests in many cases. It is not technically impossible for

coconut grove owners and seashore villagers to use different layers of coconut groves. For example, Citrus, pine apples and coffee are grown under coconut trees in the Philippines, where various other examples are reported. However, it is an important role of administrative agencies to resolve conflicts which may occur in connection with the land use right and occupancy problems to control is not always easy. A possible measure is to establish a system which will ensure both the right of coconut owners to administrate their land and the right of cultivators to harvest and sell farm products grown under coconut trees. It does not seem to be very difficult for the Philippines that has developed ISF to date. It can be expected that the participation of the local people in mangrove protection will be promoted by a package of measures which combines mediation for this type of land use with the responsibility for mangrove conservation and management.

A solution to the second problem is closely related to the recovery of abandoned fishponds. It would be important to encourage the local people to conserve mangroves by combining mangrove reforestation with the right to use fishponds and partially use mangrove timber. It is expected that a system would be created to permit people to collect firewood at a certain rate in mangrove plantations and entrust them with the conservation and management of forest areas around the plantations.

Mangrove reforestation projects relating to environmental conservation are unlikely to be adopted by the local people with much enthusiasm. Such a conservation measure is likely to eventually lead to reforestation directly managed by the government without the participation of the people. The successful completion or even implementation of any conservation project will be disrupted without including the active participation of the local people. Therefore, it should be considered that areas of mangrove forest be designated to allow a certain level of timber use as well as conservation in order to involve the local people in the project.

(3) Mangrove Re-afforestation

Re-afforestation may be the key to Mangrove Management and Conservation plans. High percentages of the target areas for mangrove re-afforestation are located in high inter-tidal zones and abandoned or less used fishponds than in low inter-tidal zones along the coastline. In the former zones, direct seeding of *Rhizophora*, a commonly applied technique, is difficult to succeed. Thus, species diversification, and new planting techniques to be introduced and it's extension efforts are requested.

As previously defined, the Mangrove Conservation Plan will cover inter-tidal areas of the remaining mangrove forests plus deforested mangrove areas to be reforested and less mangrove forests allowable for conversion. Of course, mangrove reforestation will be carried out on such land.

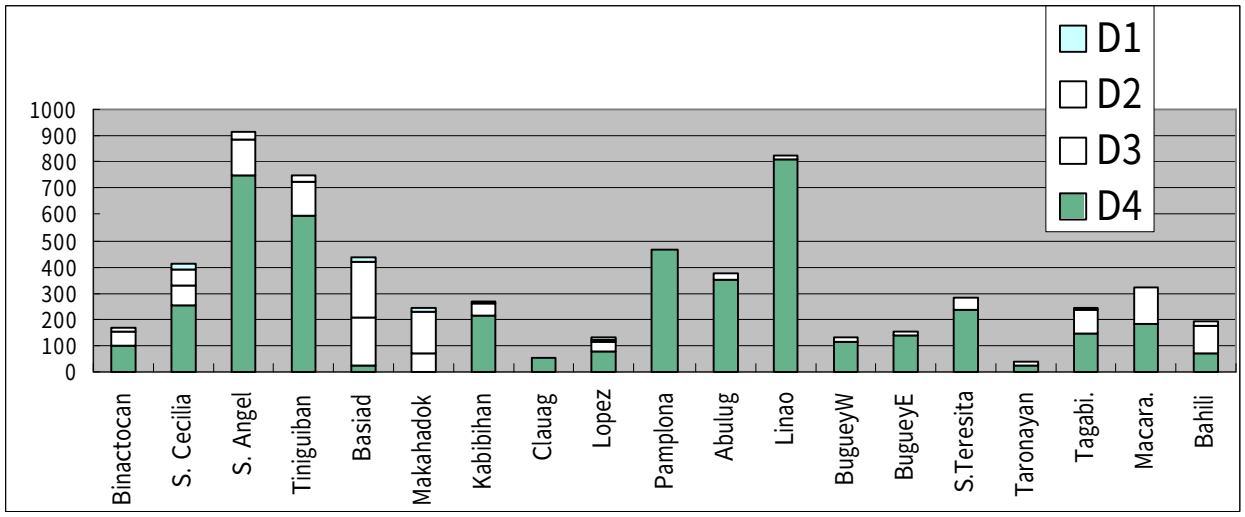
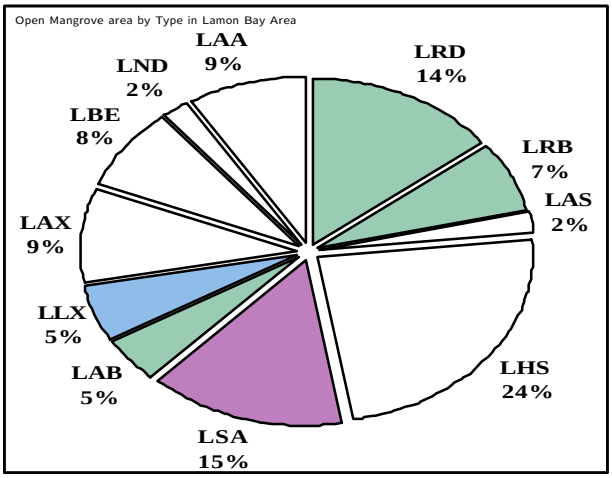


Fig. 3-3 Mangrove Area by Crown Density

Table 3-4 Open Mangrove Area by Zone (ha)

	Binactocan	S. Cecilia	S. Angel	Tiniguiban	Basiad	Makahadok	Kabibihan	Clauag	Lopez	Total	Pamplona	Abulug	Linao	BugueyW	BugueyE	S.Teresita	Total	Taronayan	Tagabi.	Macara.	Bahili	Total	Gland Tota
D4	102	252	750	592	22	1	212	50	77	2057	464	353	808	116	136	238	2115	22	144	185	69	421	4593
D3	51	76	134	130	182	67	48	4	38	730	2	20	14	15	14	46	110	17	94	135	105	352	1192
D2	15	64	31	24	214	159	4	1	11	522	0	0	0	3	2	1	6	0	4	0	15	19	547
D1	2	21	0	0	16	18	0	0	6	63	0	0	0	0	2	0	2	0	0	0	0	0	64
Tot	170	412	915	746	434	245	264	55	132	3372	466	373	822	133	154	285	2233	40	242	320	189	791	6396

As a first step, the remaining mangrove forests will be analysed. In this study, mangrove forests were mainly classified according to vegetation characteristics into compartments and sub-compartments, which were shown on the map. At the same time, the current state of forests was determined on a compartment basis by interpreting aerial photographs and described in the inventory book. Their descriptions include crown density, which is classified into D4, D3, D2 and D1:i.e., forests are covered with a crown of more than 70%, 69-40%, 39-10% and less than 10%, respectively.



Lamon Bay Area

Type	Ha	Remarks
LRD	84	Low inter-tidal zone R.a
LRB	41	Low inter-tidal zone R.a, Ct, Bg
LAS	12	Low to Middle inter-tidal Ao, Bg, Bs
LHS	140	High inter-tidal Zone Hl, Xg
LSA	85	Sea ward fringe Sa
LAB	27	Higher Middle inter-tidal Ao, Sh, Xg
LLX	32	High inter-tidal zone Mix
LAX	54	Middle to high inter-tidal Mix
LBE	47	High inter-tidal Ea, & Bush
LND	11	Riverside Nf
LAA	52	Middle inter-tidal Ao &Mix
Total	584	

Fig. 3-4 Open Mangrove Area by Type

Figure 3-3 graphically represents the area of mangrove forests in terms of zone and crown density. The area of mangrove forests with a density of less than 40% (D2 and D1) is shown in Table 3-4. In the Aparri area, an open forest area occupies no more than 7 ha of the 2,233 ha mangrove area containing nipa. Similarly, such areas in the Lamon Bay area and the Ulugan Bay area are 584 ha of the 3374 ha mangrove area and 19 ha, respectively.

Figure 3-4 shows where the open mangrove areas are connecting with mangrove forest type. Types LAA, LAX and LBE are mangroves topographically extending in middle to high inter-tidal zones. They are located in large tidal bays and featured by a maze of small creeks and mud mounds. Differences in micro-topography are reflected in the composition of mangrove species. They appear to be a mixture of small mangrove groups of various types. That is why zonal distribution cannot be easily seen. To plant mangrove species in these zones,

special measures should be taken: e.g., careful selection of suitable species in response to changes in micro-topograhy and careful planting, or grading the forest floor to a certain tide level, and provision of waterways.

Thus, according to vegetation characteristics of open mangrove areas analysed above, there are limited areas available for the direct seeding of *Rhizophora* or *Bruguiera* and *Ceriops tagal* generally planted in the Philippines. Of all open mangrove forests with an area of 584 ha, the available area for direct seeding is estimated at most to be 170 ha or 30%, including LRD (84 ha), LRB (41 ha), and some of LAX (54 ha), LAS (12 ha) and LAA (52 ha) (40% of the latter is assumed). These open areas are actually scattered over a wide expanse. If each site is required to have a certain area for a national reforestation project, it is reasonable to estimate the available area at about 100 ha.

Areas to be noted next are these deforested which must be reforested in the future. As already stated, over 50% of mangrove forests have been already converted into fishponds in some cases, where about 36% of these fishponds do not seem to be actively used. The total area of such fishponds is 1,300 ha of the seven combined zones where fishponds account the majority of land use.

There are few reports on silvicultural techniques to reforest abandoned fishponds. Silvicultural techniques must be examined on a case-by-case basis because actual planting conditions vary from one another, including the inter-tidal level and the exposure to acid sulfate soil. Mangroves have already invaded a considerable area of fishponds in some cases. Stumps were not removed before fishpond development and sprouts can be expected to grow in some other cases. Natural conditions are favourable for planting in other cases. On the other hand, there are also some cases which need to develop techniques and methods for introducing new planting species. Many abandoned fishponds are actually distributed in inter-tidal zones higher and more inland than are suitable for Rhizophora. In many cases, they are surrounded by an environment in which the Philippines have seldom experienced forestation.

As discussed above, the reforestation of extensively distributed man-grove forests, including mangrove improvement or fishpond rehabili-tation, will require

new technology and funds because the growth of mangrove forests is difficult by means of conventional direct seeding with *Rhizophora apiculata* and *Rhizophora mucronata*. Seedling production is indispensable for introducing new forest species. There are only limited number of species with seeds large enough to collect such as *Rhizophora mucronata*. On the other hand, *Scnneratia alba*, *Sonneratia caseolaris*, *Avicennia officinalis*, and *Heritiera littoralis* do not fit direct seeding. In the case of *Bruguiera* and *Ceriops tagal*, seeds can be collected with little difficulty but are too small to extensively cover inter-tidal areas, where seedlings must be planted. To expand rehabilitation planting of mangrove areas in the future, and diversification of species for forestation is essential. Such diversification requires the seedling production of many mangrove species, the establishment of criteria for selecting suitable sites, and the development and spread of silvicultural techniques. There is also a pressing need to create nurseries and extend nursery techniques.

There are many attempts to apply various silvicultural techniques at different inter-tidal levels in Indonesia, Malaysia and other countries. There are many reports on techniques which are also applicable in the Philippines. It is an urgent task for this country to launch a pilot project and report its results to the people concerned.

(4) Who Should Take Charge of Conserving Mangrove Forests?

Seaside villagers should take charge of conservation activities for mangrove forests, and those who have been using mangrove forests need to be organized. To this end, it is necessary to identify the benefits these people will gain by participating in conservation activities. A swap system should be introduced in which participants in mangrove conservation activities will be given a guarantee of a certain concession for mangrove forests, or support for activities in land areas aimed at realizing cash income or alternative source of mangrove woods.

Mangrove rehabilitation plans usually classify the areas concerned into protection, limited-utilisation and living-material-utilisation zones. This classification introduces some utilisation restrictions to inhabitants in and around the areas. However, conservation of mangrove forests in the Philippines results

not only in protection of precious natural environments but also, directly, the conservation of coastal fishpond dikes, tidal protection in coastal areas and promotion of coastal fisheries. However, benefits from mangrove forest conservation are not restricted specifically to fishery managers and residents. Those who will suffer disadvantages from mangrove forest conservation are clearly identified, nevertheless those who would benefit from larger fish catches due to mangrove forest recovery may broadly expanded. Therefore, it is difficult to collect charges from the benefisheries. A system reserving the exclusive fishing rights to coastal fishermen who have taken part in mangrove rehabilitation is not established in the Philippines. If such legislation were established, it would not only be difficult to enforce, but it would also cause conflicts between coastal fishermen.

If the Lamon Bay area is taken as an example, the recovery of mangrove forests benefits all the villages and all the fishermen operating in the bay. Therefore, it would be in the interests of all to set up an association where: funds are raised in proportion to the catch weights of registered fishing vessels; the DENR provides the association with grants funded by international support organisations; and coastal fishermen. Plant mangroves in assigned lots and control illegal logging. In reality, however, it is quite difficult to establish a system organising all the coastal fishermen in the entire Lamon Bay area.

Socio-economic Survey show that the proportion of the population engaged in the fishery industry is not so high even in coastal villages adjacent to mangrove forests. The owners and the operators of fishing boats are not always the same, and almost all the owners of the fishponds are also landowners. Therefore, it is difficult to expect agreement to be reached in some areas.

It is highly preferable to entrust a mangrove forest conservation project to people who are likely to gain the most benefits from the project. However, if it is impossible to identify the direct beneficiaries. What is the second best? Afforestation would be possible, if the government were to invest funds, manage the undertaking, and employ inhabitants. However, it would be difficult to manage and maintain these kinds of projects and failures have been reported all over the world.

The plantation may have to be carried out by local people and NGOs. Local people may, however, have less interest because the direct benefits are limited and difficult to recognize. (Increasing fish population is one of the good effects, but the benefit is given to the fishermen in the broad areas as well as fishermen who planted mangrove trees. Therefore, since many fishermen can obtain the benefit, they may not be able to have the motivation for the plantation. They are happy if other villagers plant the mangrove. They can get fish without any obligation. They have a right to catch fish anywhere.)

To call villagers interest and participation, other significant and substantial benefit which is not indirect one have to be prepared for the people who would plant mangrove. A swap system is one of the ideas to enable villagers to realize some kind of direct benefits and to join Mangrove Rehabilitation Initiatives by the Government. If a person joined mangrove planting activities, the Government would prepare some kind of services for example to prepare agro-forestry farm under the coconut forest. Of course, the Government has to negotiate with coconut forest owners so as to let them understand the importance of Mangrove forest rehabilitation.

This is only one of ideas. What kind of assistance is suitable for the swapping program for the seaside villagers may differ village by village. To find these programs, it may need to open PRA meeting with villagers and other concerned people.

An organisation of villagers must be organized in each Barangay to which mangrove and fishpond maintenance responsibilities are. The assignment is determined by agreement with all Barangays through the mediation of local CENROs. The government should demonstrate strong and clear policies indicating that Barangays participating in the scheme have priority in mangrove rehabilitation funding.

(5) Institutional requirements for promoting re-afforestation activities

Various rules and agreements are required to assure seaside villagers' participation from the planning stage and to make it easier for villagers' organizations to work, so that seaside villagers will be able to join the conservation activities for mangrove forests. To support seaside villagers' groups activities, institutionally as well as technically, a support committee should be established which will involve relevant administrative bodies and local governments.

For successful implementation of mangrove plantation establishment, some institutional aspects are also very important. The programs have to be supported by the local government authorities. And the Barangay committee is also have big effects to carry out the programs. The procedures to formulate programs and to draft rules to participate and to share the burden and benefits within the groups are needed. To take into these matters into account, some kind of implementation committees should be established.

The committee will act the co-ordination and assistant body to the implementation of the mangrove plantation activities carried by the Barangay people's group who have been the costum user of the mangrove forest. The committee will make basic rules concerning how to assure following matters, and monitor the program of implementation on step by step bases.

1) Implementation Stage

a. Propriety of the selection of project area, number of beneficiaries geographical and natural conditions, etc.

b. Confirmation of the land ownership of the project area, and status of other development projects targeted or being implemented in the area.

c. Delineation of the reforestation plan, and approval from the Local Governments.

d. Conduction of the explanatory meetings for the local people (including explanation on the importance, significance and benefit of the projects).

e. Formulation and confirmation of the technical specification for the planting bodies (NGOs), form and manner of reporting (weekly).

e. Confirmation of the project status upon the completion of reforestation activities compared with the specification.

2) Maintenance and Monitoring Stage of Mangrove Reforestation Projects

a To have the people understand the necessity of the cost for maintenance purposes, and to set the membership fee before accumulating capital of the organization.

b. To have written regulation of the organization (election of officials, management of fund, penalties, etc.)

c. To have a system of the periodical project status report, and establish reporting to CENRO

(6) Further Cooperation with International Cooperation Bodies

Three steps necessary for undertaking and maintaining the mangrove rehabilitation plan are summarized below.

① Publication of the government's policy to enforce the mangrove rehabilitation plan.

② Development and Extension of techniques suitable for newly ecological sites.

③ Organization of plantation agents, namely local village associations, based on specified benefits and measures to ensure the benefits, and to maintain and reinforce promotion facilities to deal with technical problems.

These three steps must be carried out along with the raising of foreign aid funds. The first step, people will be convinced of the government's strong resolution only when it undertakes plantation activities in model areas. At first it is effective for governmental agencies to conduct model plantation activities. The plantation activities will function as a demonstration of new and existing techniques. The activities are conducted in the areas where plantation is possible. The activities function as a motivation for agent groups to continue plantation activities. Especially when plantations are carried out in abandoned fishponds, inhabitants in and around the areas concerned will be greatly impressed with the government's determination.

The second step is carried out along with establishment of plantation. At an early stage, plantation activities are carried out in the areas where mangroves can be planted with existing techniques, but in the future, the activities must be conducted in areas where new techniques are needed for plantation. It is necessary to establish a government support system to carry out trial afforestation, development of plantation techniques, and education.

Considering that it is difficult for the government to carry out plantation activities continuously, it is necessary to organise people and include the participation of these organizations. A core organisation for various plantation activities should be established that mediates joint utilisation of fishponds or coconut forests, giving technological support to the people, and promotes support to the local community, including town dwellers.

2 Key Points of the Mangrove Survey for Other Areas

In this study, field survey and interpretation of the aerial photographs have been carried out, with an emphasis on the geographical expansion of the mangrove zone and the qualitative evaluation of the mangrove stands. The results of the mangrove distribution status were summarized in a forest Inventory Book and Mangrove Forest Classification Map. The data of the Forest Inventory Book and Forest Classification Map were put into the GIS Data Base. Therefore, the setting of conservation and management plans can use the GIS in various forms. Details of the methods of this study are shown in Appendix 1. The study was implemented to obtain two different objectives. One was to fix the present conditions of mangrove forests in the study area. The other was to introduce a method and show a guideline for similar surveys on mangrove forests other than the study areas in the Philippines.

NAMRIA is expected to play a central role in taking and interpreting aerial photographs if this survey is to be followed by more field surveys by the Philippine side, aimed at better understanding of the zonation of mangrove forests. Yet it is essential for Community Environment and Natural Resources Offices (CENRO) and municipal governments to participate in field surveys and the gathering of information on local residents, both of which are prerequisites for interpretation of aerial photographs. To conduct joint field surveys means to deepen common understanding of the actual conditions of mangrove forests. Such common understanding in turn constitutes a precondition for a smooth process of studying mangrove forest conservation plans that follow.

This survey has put special emphasis on the participation of staff members of CENRO as well as those of NAMRIA. As greater participation of community offices and municipalities will be needed in subsequent surveys, the study team has prepared technical manuals that explain methods for actual surveys, that is, (1) how to interpret aerial photographs, (2) how to proceed with a field survey, and (3) how to use GIS.

The study team hopes that the two (2) manuals will be used by staff members of NAMRIA not only for themselves, but as textbooks when they explain operations to field officers. Although the third (3) manual has been prepared with NAMRIA staff members in mind, the study team hopes that the people of regional forestry offices in charge of formulating mangrove conservation plans will also use the manual. The study team is convinced that the manual will help personnel on the

process and use of various data from GIS, so that they will understand the present conditions of mangrove forests from various perspectives.

The Study processes were as follows. First, the Study team took aerial photographs to understand the general distribution of the mangrove forests. Second, the Study team carried out a transect surveys on mangrove vegetation distributed areas in an area where mangrove forests were typically distributed, in order to determine the typical zoning structure. This transect survey was aimed to understand and variations of the changing pattern and land condition of mangrove vegetation within the inter-tidal area, ranging from the seashore to the landward fringe.

Third, the team, with a basic knowledge of mangrove vegetation structures obtained from the transect surveys, carried out pre-interpretation of aerial photographs. In the pre-interpretation, the aerial photographs were sub-divided into the structures of mangrove vegetation/association where the stands produced a homogeneous pattern. The small parts, difficult to divide on a 1:10,000 map, were combined to the adjoining sub-compartments and those that could be seen as part of the neighbouring stands because of their small areas were marked off.

After the field verification and final interpretation of the aerial photographs, the boundary lines were readjusted. The Areas of mangrove forests/sub-compartments were transfer to the topographical maps and the GIS database. The sub-compartment areas were calculated by computer and shown on a topographical map.

To define the stands structure of each area, the study team carried out site surveys to identify stands interpreted from the aerial photographs. The team accumulated data to indicate the relationship between the aerial photographs and the real mangrove forest structures. At the final interpretation of the aerial photographs, the data was used to indicate the stand structure characteristics such as average height and crown density.

At the same time, the team carried out a socio-economic survey aimed at understanding the relationship between local residents and mangrove forests. The use of mangrove forests by local residents and their awareness of mangrove forest conservation were also studied.

The Philippine team, who will continue the survey of the remaining areas, are expected to follow similar methods the study team introduced. Yet, to follow

exactly the same method would not necessarily be to the point because the team carried out the survey in a limited period and with limited management purposes in mind. Here are some of the points the Philippine team should take into account in conducting a survey in the future.

(1) Aerial Photograph

At the beginning of survey comes acquisition of information from aerial photographs. The proper way to take aerial photographs would be, on the assumption that a HIEI SE II camera is available, low-altitude photography with a small format camera. It is possible for NAMRIA itself to charter aircraft, but it might be more efficient to use an aerial survey company; there are such companies in the Philippines staffed with experienced photographers. It would be wise to examine the total cost performance of the operations, including not only taking aerial photographs but related processes such as development, enlargement/printing, and reprinting in relation to the budget.

(2) Drawing Basic Maps

In this study, a base map was drawn on a scale of 1:10,000, based on mosaic photographs and the existing maps on a scale of 1:50,000, after adjusting the scales of the photographs and the physical relationships of bench marks. This process should basically be followed. What kind of information should be represented on the base map should be determined according to the actual situation of each study area, and in consultation with Regional Offices of (DENR).

Time should not be used, however, for marking off items with no direct relations to the conservation and management of mangrove forests, such as various kinds of farmland or non-mangrove swamps. For the sake of efficiency, aerial photographs should be developed so that their scale will be as near as possible to the scale for the base map.

(3) Field Survey

Field survey plays the most important role. The field surveys, this time around consist of soil and salinity survey, transect survey, plot survey, and field verification survey of pre-interprete aerial photograph.

1) Soil and Salinity Survey

The soil survey is important in understanding land productivity and in deciding

the optimum species to be planted in the case of afforestation. The field survey in this study provided basic information about the ecological characteristics and the distribution of mangrove forest communities.

Yet the study team did not allocate survey plots to such a degree of density that a mangrove soil distribution map could be obtained. Concerning the relationship between mangrove soil and afforestation, the study team observed the sand quality of mangrove forest soil, the degree of clay soil, the thickness of mangrove soil (black colored soil), and the proportion of terrestrial sediments in soil. This information provides as how a given area of mangroves developed, in other words, whether it was influenced by tides or were significantly affected by sediments from land.

The salinity survey, on the other hand, can provide effective information for assuming: (i) to what extend mangroves can be recovered, and (ii) whether original mangrove forests ever existed, in areas along a large river supposedly influenced by the ebb and flow of the tides.

In future studies, the question is upto what extent a similar survey should be carried on. This report contains a certain amount of data on mangrove vegetation and on the structure and physical characteristics of mangrove soil. Besides, many studies on this topic have already been reported in the Philippines. It is not easy to carry out detailed research that will emulate these findings due to time and economic restraints.

Also, the relationship between soil and vegetation is thought to be basically not so different between the study areas. If small differences are to be verified through detailed survey, it would be difficult to assume that such differences would constitute a decisive factor in managing mangrove forests. Thus, the study team thinks it is sufficient to concentrate, as far as possible, on verifying the relationship between soil condition and mangrove vegetation as shown in this report.

The salinity survey is targeted only at areas near and a little upstream from the mouth of a large river like in Aparri which are covered with mangrove or nipa forests. It would not be necessary to repeat a similar survey, unless substantial afforestation is required in a conservation and management plan. Because the salinity of a river depends on the quantity of its flow at the time of survey, it should be understood in a relative manner. The empirical knowledge is that the average salinity is indicated by the emergence of certain mangrove species. This

relationship was commonly observed in this study as well.

2) Transect Survey

The transect survey is very important for understanding mangrove forests. It is aimed at grasping the changing situation of inter-tidal levels and mangrove vegetation. It is well known that mangrove forests show zoned structure in areas where the level of the tide continuously changed, and this was frequently observed in the study area as well. Yet zoning structures are often difficult to find in mangrove forests covering tidal flats, because areas with a slightly different inter-tidal level are complexity distributed. This results from the existence of many small rivers and water channels that emerge at low tide.

A zoning structure is relatively easily seen only on the seashore where mangrove forests extend 200-400 meters in width and there are no rivers that can be seen from the seashore. In selecting the survey area, it is important to observe mangrove forests and upland forests behind them from the seashore and compare them with aerial photographs.

The transected structure of mangrove forests varies according to each type of area with specific topographic features. For example, the structure is different at the coast, along a river, in and around a tidal flat, and around the area where a river flows into a tidal flat. But it is expected that the structure is similar within each type of area. Thus, whether the transect survey should be continued in future studies will depend on whether researchers have sufficient experience and knowledge. Researchers with good knowledge would be able to easily get the picture just looking at aerial photographs without conducting a transect survey. In this case, it was not necessary to carry out a transect survey, which requires a lot of time and energy.

Yet in many future studies that will generally require a lot of researchers, not only experienced technicians but many less experienced researchers will inevitably be involved. If this is the case, a transect survey should be carried out regardless of its scale. Nothing is more important than a transect survey if one wants to get a first-hand understanding of the actual condition of the mangrove vegetation in a study area. To remember species that emerge in various locations/land conditions and to learn the relationship between the range of the tides and the group of species through a field survey is to acquire knowledge and experience essential for interpreting aerial photographs.

3) Plot Survey

The plot survey is vital. It is designed to gather data that will serve as references for aerial photograph interpretation, which is indispensable for compiling forest inventory results. Marking the precise locations of plots on an aerial photograph and then linking this photograph with the actual stand composition make it possible to stratify and evaluate the stands structure of mangrove forests that cover a large area. The larger the number of plots, the easier the subsequent work.

Here are the procedures for selecting plots. First, group compartments and sub-compartments are tentatively marked off on the aerial photographs according to the type of mangrove forest vegetation. Second, estimate the area of each group. Third, distribute a feasible number of plots proportionally according to area so as to come up with the targeted number of plots for each group. Fourth, observe closely the aerial photographs and mark on the typical features that are thought to represent each vegetation group.

Before plot selection, the surveyor should conduct a survey for understanding the general condition of the field. It is important to compare the aerial photo image with the structure of the actual mangrove forests such as species composition, distribution, tree heights and crown size, topographical features and the distribution of such forests in areas along rivers and around tidal flats. Such comparison makes aerial photo pre-interpretation efficient and precise, leading to smoother operation of the whole survey. It is effective to carry out this kind of survey in preparation for the pre-interpretation when conducting transect surveys discussed above.

The above-mentioned survey for holding the general condition should cover as wide an area of mangrove as possible by making the effective use of aerial photos, maps, information from local residents, and by utilizing available land access, marine traffic facilities and rivers. After the plots are mapped out, it is necessary to visit their exact position. The efficiency of the survey depends on the accessibility to the plots. What route to choose for reaching the plots and what features can be used to confirm land marks must be fully considered. Areas should be excluded from the list of plots if their locations cannot be confirmed or require a long travel time. Such areas would confuse researchers; if they would take the risk of linking the data of the wrong place with the wrong aerial photo imagery.

It is not easy to answer the question of how many plots should be set up. Various factors should be taken into account. These factors include not only the conditions of the mangrove, such as how many kinds of vegetation features are expected to be shown on the aerial photos and how far the study area extends. The number of available technicians and the budget for travel and other expenses cannot be ignored as well. Of course, survey objectives, in other words, to what extent a forestry inventory book should be detailed and what the mangrove forest management plan will be like are also important factors.

The practical way would be this. First, compute the targeted number of plots based on the budget, the number of available technicians, and the number of days available for the survey. Second, take into account the general condition of the mangrove shown by the preliminary survey and information obtained from aerial photos. Third, distribute the targeted number of plots according to the expanse (total area) of each group classified by vegetation type. In the case of our study team, four experts visited four plots per day per person.

Then, here is how to determine the size of survey plots. The size depends on the survey objectives. If the estimate of growing stock is needed all over the study area, the following measures may be necessary. First, classify forests not only by vegetation type but by tree height and crown density in parallel with pre-interpretation of the aerial photos. Second, stratify them according to expected volume class. Third, distribute plots in accordance with the proportion in area of each stratification. At the same time, it may be necessary to meet the area standards set by the Philippine government. (In general, survey criteria for management planning of Dipterocarpaceae forests should not necessarily be the same as those for a mangrove management plan. This is because mangrove forests have a very simple structure compared with Dipterocarpaceae forests. Also, mangrove forests classified as one group according to vegetation or forest type is much smaller in area.)

In practice, it is perceived that unlike Malaysia and Thailand, mangrove forests that can be managed for wood production is quite limited in the Philippines. (Even the Ulugan Bay area, which was perceived as a conservation area in this study and is thought of as virgin forests, would be judged as inappropriate for wood production in terms of volume if it was regarded as a non-conservation area. From a viewpoint of management, sustainable wood production would be inappropriate even in this area.) Therefore, it is safe to say that the main objective of a mangrove forest survey is to understand the general condition, an action necessary for formulating a conservation and management plan. Such a

plan focuses on the conservation and recovery of forests and allows limited use of fuelwood by local residents, in accordance with basic policies for mangrove forests in the Philippines. Thus, it is not necessary to put a lot of time and energy into estimating the growing stock of mangrove forests.

The main objective of the plot survey is to identify the present condition of forests (main species, tree heights, the size of main trees, crown size, stratification, density, species and number of trees to be planted in the case of afforestation, and other information necessary for planning the planting method) for a forest inventory book, and to gather data for interpreting aerial photos. Thus, the area of each plot does not play a very important role. Yet if a plot is too small in area, this might cause trouble. An area that looks homogeneous on an aerial photograph may contain spots of different natures. These spots might be chosen as samples. Therefore, the minimum unit of 15m x 15m (1.5mm x 1.5mm on an aerial map on a scale of 1:10,000) would be appropriate. This is appropriate in terms of survey efficiency as well. In this survey, the plot size ranged from 14m x 14m to 28m x 28m. The 14m x 14m size was applied for areas that looked almost homogeneous on an aerial photograph and was densely covered with shrubs. The 28m x 28m size was applied when the height of dominant trees should be taken into account.

4) Field Verification

Field verification is one of the most important activities for interpretation of aerial photos, through which researchers judge how actual forests are recognized and identified on aerial photos. Photo images are expressed in indexes and their colors in color codes, but this does not mean that it is possible to determine species based on such information. The elements of an aerial photograph are shape and size, color tone, pattern and texture, and these elements of the same object cannot possibly be represented identically in any photos. Unerring judgement of aerial photos comes mainly from experience and knowledge about the actual distribution of mangrove forests.

Such judgement will be developed through constant comparison of aerial photo imagery with actual mangrove forests at a time of pre-interpretation, preliminary survey, transect survey, and plot survey. If the survey period or manpower is limited, more time and energy should be put into the verification of pre-interpretation aerial photo results than into the plot survey. A survey in which researchers spend a lot of time just roaming around mangrove forests cannot be tolerated. Be always critical about the results of pre-interpretation. Choose the appropriate place for verification. Observe the actual stands.

Review aerial photo imagery from a different perspective. This will acquire the skills to unerringly judge aerial photo imagery.

(4) Socio-economic Survey

Upon the conduction of the assessment studies on Mangrove areas, survey on the socio-economic aspects has significant importance and necessity so as to grasp the concern of community people of the area surrounding Mangrove forest, in consideration with the fact that the main reason of the decrease of Mangrove forest is on the human activities such as conversion to fishpond, firewood cutting, etc.

With regard to the future nationwide expansion of this Study by the concerned Agencies of the Philippines Government, the following aspect shall be taken in to consideration on the socio-economic aspects of such studies.

1) Selection of proper Survey Method with Consideration of Resources, Budget and Time Frame of the Executing Agency

The interview survey on sampled informants used in this Study requires certain time and cost (employment of survey staff, field cost, etc.) from the time of the designing of questionnaire to the conduction of interview, tabulation and analysis. As for the studies in the future, it is necessary to consider alternative option of the survey method and select most suitable survey method with consideration of the resources, budget and time limit, such as the interview survey with limited selected a sample/questionnaire, utilization of RRA (Rapid Rural Appraisal), partial utilization of existing past studies and group interview by forming group consists of the representatives of groups with each roles (professional and geographical distribution) of the target communities.

2) Consideration of Community-based Survey by the Coordination with Local Government Units

It is necessary to obtain cooperation and understanding from the Local Government Units, especially by the Municipality level, to conduct survey in the committees. However, it shall be noted that the following points must be taken

into consideration; 1) possibility of the effect to the survey when there are directly concerned persons and/or prominent officials in municipality who are directly engaged in the Lumber Permit, Fishpond Lease Agreement, etc. 2) effect to informants when Municipality Official accompany the survey team on the community level survey. Sometimes it actually happen that informants refuse or hesitate to cooperate on such survey, considering it as the basis of taxation, etc.

3) Understanding on the Environment Related Law Systems in the Study Area and their Implementation Status

There are some legal systems on the conversion of Mangrove forests such as Private Land Conversion Permit, Fishpond Lease Agreement, and also Coastal Environment Program as well se Community-based Forest Management on the conservation of Mangrove forests. It is quite important to recognize the implementation status of such systems, and there is no use formulating future projects without considering this aspect. Furthermore, upon the formulation of project as for the countermeasure on the conversion of Mangrove forest to fishpond which is one of the biggest factor of the decrease of Mangrove forest in the Philippines, it is necessary to conduct pre-survey on the use condition of fishpond, legal statue, ownership, status of mortgage by bank, and absentee owners who are presently outside study area or abroad.

4) Understanding on the Living Condition, Economic Condition in the Study Area and Consideration on the Traditional Social Customs in the Area

It is important to consider the living condition of the communities which seems having less relation to the Mangrove forests, such se to look into the alternative fuel source on the survey of Mangrove use as firewood. Also, it is necessary to consider local industrial structure which differs area by area, such as the Nipa industries in Aparri area was taken into consideration for the understanding of Mangrove use in this Study. Furthermore, when there is the traditional people's group (such as "Bayanihan" in the study areas, it is' also important to take such traditional customs into consideration to estimate the possibility on the implementation on the small-scale projects in the community level.

5) Consideration on the Chronological Aspect

Upon the survey on the use condition of Mangrove by the community people, it is important to grasp the past use condition and their intention to use in the future, not only the present use condition. Especially, to grasp their intention in the future, estimation on the possibility of future use shall be made by considering the future change of their lifestyle (possibility of alternative fuel sources, feasibility of fishpond management) and people's recognition on the importance of the conservation of Mangrove forests.

Bibliography (III)

1_/ FAO 1982: management and utilisation of mangroves in Asia and the pacific: chapter 1-5 *FAO Environment Paper No3* Rome

2_/ Lawrense S. Hamilton & Samuel C. Snedaker 1984 Handbook for Mangrove Area Management: Section 1 Environment and Policy Institute East-West Center, IUCN, UNESCO

3_/ Bernardo Dumlao Agaloos 1994 Re-afforestation of Mangrove Forests in the Republic of the Philippines *Development and Dissemination of Re-afforestation Techniques of Mangrove Forests* Bangkok, Thailand, International Tropical Timber Organization

4_/ FAO 1982 Management and utilization of mangroves in asia and the pacific *FAO Environment Paper No 3* (Chapter 2)

5_/ N.J. Stevenson 1997 Disused Shrimp Ponds: Options for Redevelopment of Mangrove : Center for tropical Coastal Management University of Newcastle UK

6_/ FAO 1994: Traditional and Potential Uses of Mangrove, *Mangrove forest management guideline*: FAO Forestry Paper 117 Part II

Colin Field 1996 Restoration of Mangrove Ecosystems, The International Tropical Timber Organization(ITTO) and The International Society for Mangrove Ecosystems(ISME)

P.B. Tomlison 1986 The Botany of Mangroves, Press Syndicate of the University of Cambridge

ISME 1993 Proceeding of VII Pacific Science Inter-Congress Mangrove Session, *Mangrove Ecosystems Proceedings No 3*, International Society for Mangrove Ecosystems

Francic Dov Por , Inka Dor 1983 Hydrobiology of the Mangal, the Ecosystem of the mangrove forests, Kluwer Academic Publishers Group

Peter Kunstadter, Eric C.F. Bird, Sanga Sabhasri 1985 Man in the Mangroves the Socio-economic Situation of Human Settlements in Mangrove forest, The United Nations University

M.Suzuki,S.Hayase, S. Kawahara Sustainable Utilization of Coastal Ecosystems, Proceedings of the Seminar on Sustainable Utilization of Coastal Ecosystems for Agriculture, forestry and Fisheries in Developing Regions, *JIRCAS Working Report No 4*, Japan International Research Center for Agricultural Sciences

(JIRCAS)

Felix R. Gonzales 1977 Mangrove and Estuarine Area Development in the Philippines, International workshop on Mangrove and Estuarine Area Development for the Indo Pacific Region

RS. Jara 1985 Traditionalizes of the Mangrove in the Philippines, *Mangrove Ecosystem of Asia and Pacific States, exploitation and management*, Proceeding of Research for Development Seminar, Australian Institute of Marine Scenes, Tawnsville, Australia

Dioscoro M. Melana 1982 Research and Development Status of Philippine *Mangroves, Symposium on Mangrove Forest Ecosystem Productivity in Southeast Asia* BIOTROP Special Publication No 17

Honorato G. Palis 1997 Community-Based Approach to Restoration of Mangrove Forest In the Philippines *Green Productivity In Pursuit of Better Quality of Life*, Asian Productivity Organization Tokyo