Community-Based Mangrove Reforestation

Coastal Resources Management Tools

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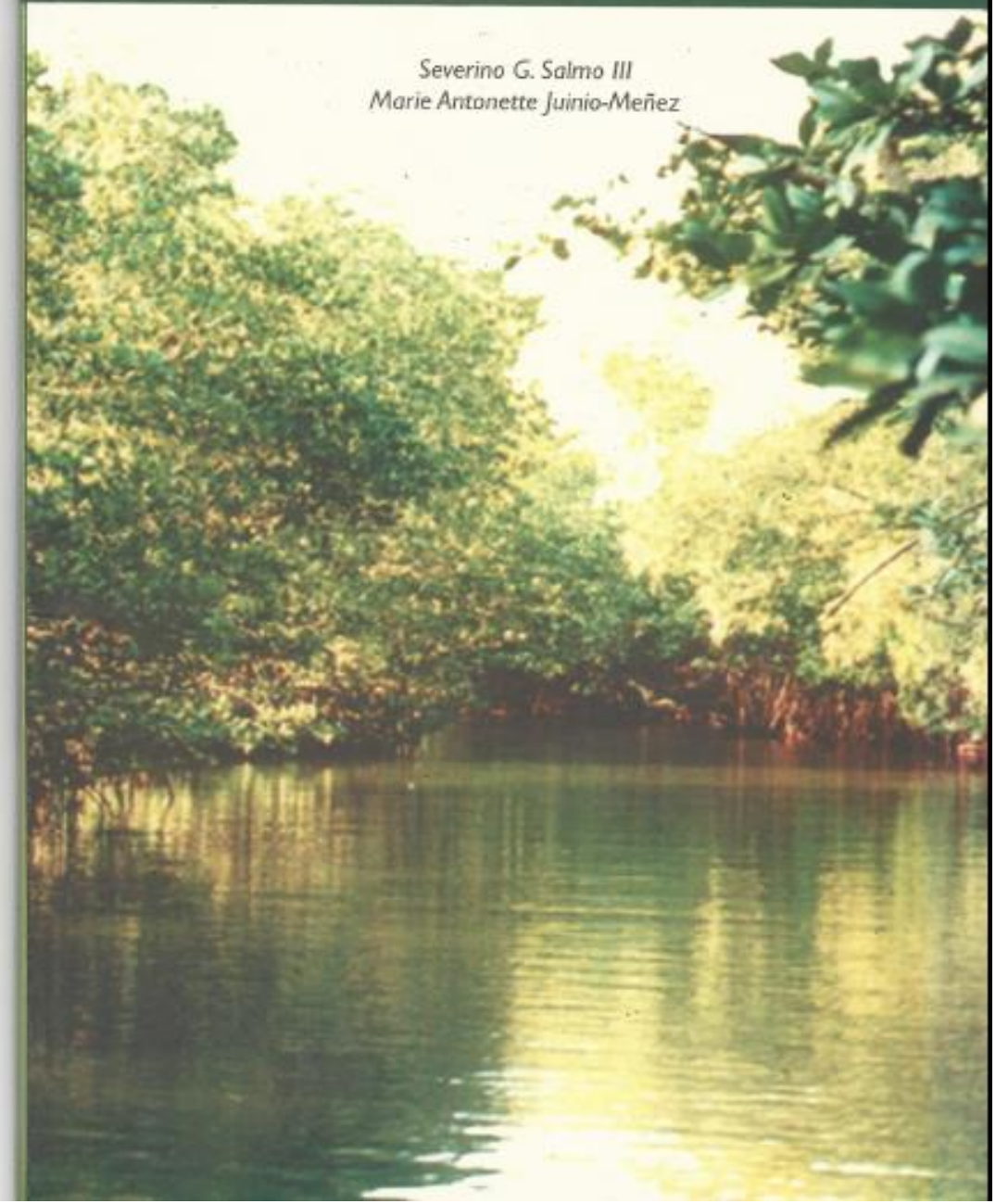

Front cover photo
An old stand remaining from a mangrove (mangal) community on the mouth of Balingasay River in Bolinao, Pangasinan – a portion of which was converted to aquaculture ponds.

Mangrove Reforestation

COASTAL RESOURCES MANAGEMENT TOOLS

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Enhancing Community Participation in
Fishery Resources Management Project
Marine Environment Resources Foundation, Inc.
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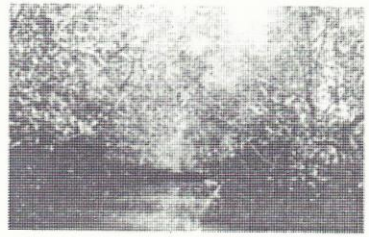


Introduction

The rapid degradation rate of mangrove ecosystem makes mangrove reforestation inevitable. There have been many attempts at mangrove reforestation in the Philippines but unfortunately, most of these projects failed due to various factors, primarily technical and social in nature.

The few successful cases reportedly capitalized on concerted efforts with coastal communities that are adjacent to mangrove forests. It has been proven that heightening environmental awareness (i.e. through various informal and semi-formal environmental education sessions) is an effective strategy to mobilize and motivate the coastal communities to undertake mangrove reforestation.

The lessons from both successful and unsuccessful cases proved crucial to the Marine Fishery Resources Management Project (MFRMP) in designing and implementing community-based mangrove reforestation in Barangay Pilar, Bolinao, Pangasinan.

The mangrove reforestation project has had several successes, including an 80% seedling survival rate, in spite of some failures such as encroachment, typhoon damage and pests infestation.

Nevertheless, the project has shown great potential to be sustained primarily because of the steadfast commitment of partner-groups to manage the project; and technical and financial assistance from various institutions.

The contents of this manual are drawn mostly from MFRMP's experiences in working with a people's organization from 1995 to 2001, towards establishing and managing the mangrove reforestation project in Barangay Pilar, Bolinao, Pangasinan. Although the methods outlined in this manual are not prescriptions to a successful reforestation program, these are meant to serve as a guide for future reforestation endeavors.

Module 1: Orientation

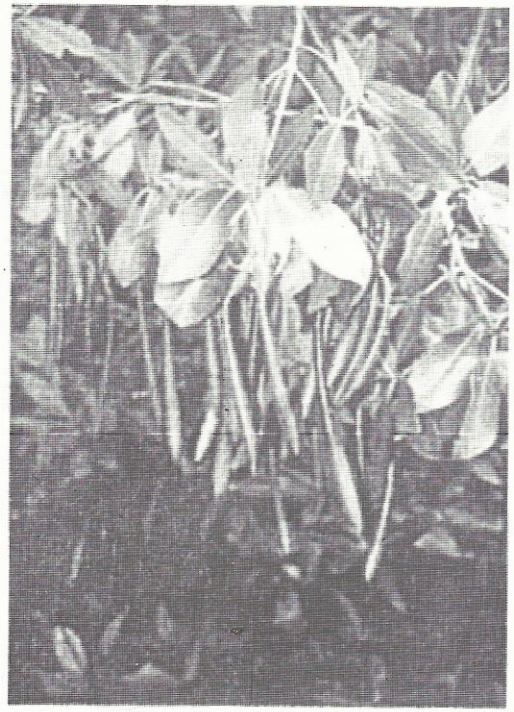
Biology

Mangroves are tropical flowering plants that belong to different families. There are more than 50 species of mangroves in the world occupying an estimated total area of 24 million hectares. The most important genera of mangroves are *Rhizophora, Avicennia, Bruguiera* and *Sonneratia*.

Mangrove trees have the common characteristic of growing in shallow and muddy salt water or brackish waters, and only on shores sheltered from strong wave action. These shores are usually along the lee sides of an island or on a land mass protected by offshore coral reefs and seagrass beds. But mangroves are particularly well developed in estuarine areas, where they grow to their fullest extent.

The mangrove is shallow rooted, with roots spreading horizontally or shooting down from the trunk. Roots that extend from the substrate to the water surface—pneumatophores—act as aerating organs, allowing

Mangrove trees have the common characteristic of growing in shallow and muddy salt water or brackish waters, and only on shores sheltered from wave action.



While still on the parent plant, the seed germinates and begins to grow into a seedling without any intervening resting stage.

the plant to receive oxygen in spite of the anoxic mud in which they grow. Because of the saline environment, mangroves evolved tough and succulent leaves with internal water storage tissues.

While the extensive branches of the mangrove are sanctuaries to birds and other terrestrial organisms, the tangled masses of arching roots below water are home to snails, bivalves, crabs, shrimps, some fishes (i.e. mud-skippers), and various marine animals.

Mangroves flourish in different environmental settings: pure clay, peat, sand or coral rubble. The trees are most productive under conditions of moderate salinity (25 ppt), neutral acidity (pH 6 to 7), year-round warm temperatures, regular surface-water flushing, and exposure to moderate terrestrial-water runoff.

The *Bruguiera* and *Rhizophora* species have developed a peculiar form of seed germination and dispersal. While still on the parent plant, the seed germinates and begins to grow into a seedling without any intervening resting stage. During this time, the seedling elongates and becomes heavier at the outer free end.

Eventually, the seedling drops from the parent plant and, because of its weight distribution, floats upright in water. The current sweeps the

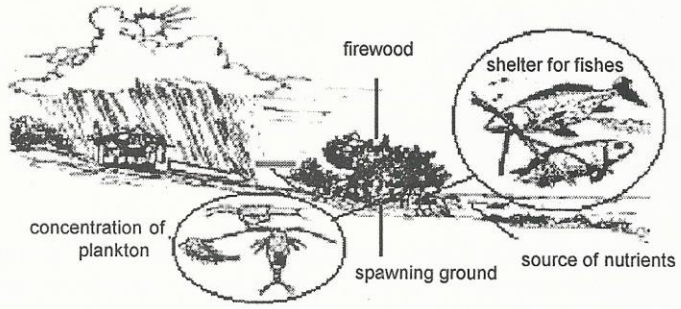
seedling to waters shallow enough for its root to reach the bottom. The seedling then develops roots to anchor itself, to eventually grow out into a tree.

Interconnectivity of Coastal Ecosystems

(Juinio-Meñez, et. al. 2000)

Mangrove forests—along with coral reefs, seagrass beds and estuaries—are the major life-support systems of the coastal zone. These ecosystems are connected by interactive processes, which maintain their stability and functional roles. These ecosystems are interconnected in terms of physical aspects, nutrient transport, animal migrations and human impact.

Importance of Mangrove Forests



Ecological importance

- helps in maintaining coastal water quality
- reduces the severity of coastal storms, waves and floods
- serves as nursery and feeding grounds for commercial and artisanal fishes
- an important habitat for a range of benthic and pelagic marine animals and birds

Socio-economic importance

- an abundant source of forest products, e.g. firewood, charcoal
- a rich source of fishery products
- are areas of human settlement and development

Mangrove forests trap the eroded soil from upland terrain to filter the sediments flowing to estuarine areas. Seagrass beds stabilize the sea bottom with its roots, so that particles swept to coral reefs are controlled. Coral reefs reduce potential damage that can be caused by wave and current actions that reach the seagrass beds and mangrove forests.

The litter materials of mangrove forests are transported to seagrass beds, where it is first filtered before continuing downwards to the coral reef. Organisms living in estuaries often generate more nutrients than they can use, resulting in the export or outwelling of nutrient and organic detritus into the adjacent coastal area.

Perhaps the most evident ecosystem interaction is animal migration. Different species of fish and invertebrates pass, feed, and spawn in each of these ecosystems.

Consequently, an ecosystem's destruction due to human impact (e.g. discharge of toxic wastes) largely affects other coastal ecosystems.

The detrimental effects of deforestation in upland areas reverberate down to coastal ecosystems. When a tree is cut it releases the soil that is held in its roots, releasing sediments into the nearby coastal areas. These sediments eventually accumulate on estuarine areas—consequently reducing the supply of dissolved oxygen, causing water pollution or eutrophication.

Because of tidal action, the polluted water reaches the adjacent coral reefs, seagrass beds and mangrove forests thereby adversely affecting their respective ecological functions.

Threats

(Melana, et. al. 2000)

Direct (human intervention)

- conversion to fishponds and saltbeds
- reclamation for various developments (e.g. wharves, piers, airports, housing project, etc.)
- pollution and siltation
- dikes and structure obstructing waterways and tidal inundation
- overexploitation/utilization
- disturbance due to gleaning, fish landing, etc.

Indirect (natural phenomenon)

- pests and diseases
- typhoons

Status

Of the original Philippine mangrove forest cover of 500,000 hectares in 1918, only 139,100 hectares remained in 1989. According to the recent survey conducted by DENR, the Philippines has only 117,000 hectares remaining mangrove forest cover (DENR, 1995). A deforestation rate of 6,685 hectares per year from 1950-1972 alone could be attributed to massive conversion to fishponds.

***Information on the status of mangrove forest in the locality** should be determined. Data may be requested from the nearest DENR offices or academic institutions. Supplemental information and/or local knowledge and beliefs may also be gleaned from interviews with local senior citizens. Gather data on: estimated original area and location of mangrove forest, estimated present area and location of mangrove forest, mangrove species present, uses (actual and perceived); causes of destruction (if any) and perceived threats to the occurrence of mangroves.*

Module 2
Mangrove Reforestation

The Need for Mangrove Reforestation

Mangroves prevail over environmental and socio-economic stresses, continuing to re-establish and adapt by using its shallow, aerating roots; tough, succulent leaves that store water; and seeds that have a unique manner of germinating and dispersing. The germination and dispersal of its seeds is the mangrove's most significant way of propagating itself.

The natural regeneration of mangroves cannot compensate for the alarming rate of destruction of mangrove forests. It is for this reason that various mangrove reforestation projects have been undertaken in the Philippines.

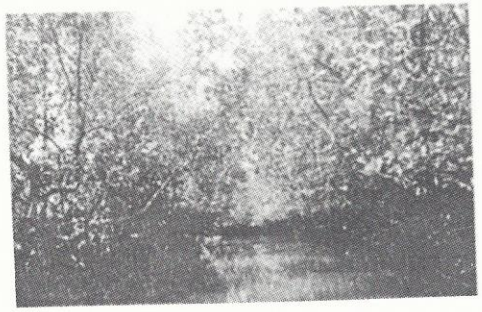
Mangrove reforestation is a resource management option for rehabilitating or restoring the mangrove ecosystem to compensate for lost ecosystem services. It entails planting of seedlings or propagules, or transplanting wildlings to the reforestation site.

Although reforestation projects have been implemented in the Philippines, most have failed because of technical/bio-physical, management-related, and social factors. But success can still be achieved if the community has direct involvement in the maintenance of the project by replanting, repair of fences and performing other relevant tasks (Fortes, 1995).

To help ensure sustained management, the reforestation project should be undertaken within the context of a comprehensive coastal resources management (CRM) program. These CRM programs should promote

sustainable and equitable management of coastal resources, and empower local communities to be responsible stewards in resource management.

Comparison Between Natural Regeneration and Mangrove Reforestation



natural regeneration

Natural Regenaration

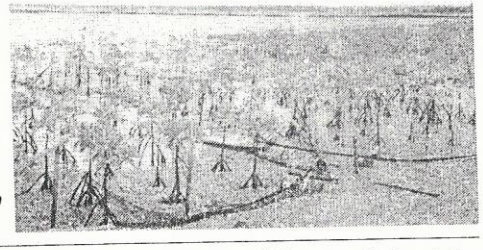
Advantages
- resulting forest is likely to be more similar to the original mangrove vegetation
- less labor and finances is required
- less soil disturbance
- planting naturally takes place

Disadvantages
- limited seeds and propagules may take a long time to reforest the area
- poor natural regeneration due to weed competition, excessive amount of plant debris, poor soil conditions or disturbed hydrodynamics of the site
- low natural recruitment and survivorship

Mangrove Reforestation

Advantages
- species composition, distribution of seedlings and planting distances can be regulated
- difficult or pest infested areas can be more easily restored

Disadvantages
- more expensive due to labor and finances required
- timing of planting could be constrained by the availability of seeds, tidal regime, onset of typhoon



mangrove reforestation

The mangrove reforestation project can take on either a community-based or co-management approach. The community (usually through a people's organization) spearheads planning, implementation, monitoring and evaluation of any community-based initiative. Co-management entails cooperation between the people's organization (PO), local government units (LGU), non-government organization (NGO), and academe in managing the project.

While there is no standard approach in undertaking CRM, it is important to have a core implementing institution (a PO or LGU or a PO-LGU partnership) that will implement the day-to-day management of the project.

The objectives of mangrove reforestation are:

- to compensate for the lost ecosystem services due to destruction of mangrove forests;
- to protect the coastal area against ecological disasters (e.g. typhoons); and
- to restore natural system for sustainable utilization of resources.

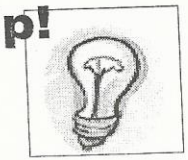
Recognizing the limits of the capabilities and skills of the group at the onset of the project will make it easier to evaluate where and how to tap possible financial and technical assistance [refer to Table 1]

Table 2: Sample Criteria for Success

Parameter(s)	Low	Medium	High
Ecological impacts* • increase in abundance and diversity of marine resource per unit area • growth of mangrove (refer to section on monitoring) **Socio-economic impacts*** • increase in fish/shellfish catch **Community participation** • heightened environmental awareness • level of participation in the management of the project, e.g. monitoring, repair of fences/ nets, replanting			

**should have a baseline data prior to the implementation of the project.*

tip!



The criteria for each parameter should be clearly defined. In socio-economic impacts for example, at what rate or percent (e.g. increase in abundance per unit area per unit time) did the project result to a low (e.g. 1-25%), medium (e.g. 26-50%) and high (>50%) impacts in fish catch?

Formulating the criteria for success during the conceptualization stage is necessary to determine the progress of the project (refer to section on monitoring) and in facilitating future project evaluation, particularly, what percentage of the objectives has been accomplished [refer to Table 2].

Suggested Program for Training Seminar:

ACTIVITY/TOPIC	METHOD	ESTIMATED TIME
1. Registration		15 minutes
2. Opening ceremonies		10 minutes
3. Introduction of participants		15 minutes
4. Rationale and objectives of the activity		15 minutes
5. The coastal environment: features and status*	Lecture	30 minutes
6. Issues and problems in coastal resources management*	Workshop	30 minutes
7. Resource Management Options*	Lecture	30 minutes
8. Break		60 minutes
9. Mangrove reforestation as a tool for coastal resources management (found in this training module): - Mangrove biology - Status and threats of mangrove forests - Why mangrove reforestation? - Steps in mangrove reforestation - Causes of failures (and success) of mangrove reforestation	Lecture (refer to Module 1)	 20 minutes 10 minutes 10 minutes 30 minutes 15 minutes
10. Open forum		30 minutes
11. Action planning	Workshop	60 minutes
12. Assessment		30 minutes

** suggested reading: Juinio-Meñez, et.al. 2000. "Bugsay." Community Environmental Education: Experiences from Bolinao, northern Philippines.*

Preparatory Activities

Objectives:

- Aside from providing an understanding of the biology of mangrove, the training seminar could help instill to the community the importance of mangrove reforestation; and
- serve as a venue to provide strategies and technical guidance for the establishment and management of the project.

Target participants: 40-50

Materials needed:
visual aids illustrating the biology and importance of mangroves, markers, yellow paper, ball pens, envelopes, video tapes

Time needed: ~7 hours (1 day)

Pre-seminar activity:
- ground working
- preparation of the training venue and logistics
- dry-run for resource persons and facilitators

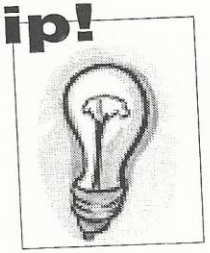
1. Environmental Education

The conduct of environmental education is necessary to heighten the environmental awareness of the community and encourage them to participate in undertaking mangrove reforestation.

2. Community Mobilization

Not only members of the implementing group, but also additional support from the community can be tapped through mobilization activities.

tip!



If the implementing group has the capability to conduct environmental education, then its members should be tapped as resource persons. Otherwise, external group (e.g. DENR, NGO, academe) should be requested to serve as resource persons.

Mobilization can be in the form of information campaigns and community consultations. Information campaigns (i.e. posters, leaflets, one-on-one discussion) are necessary to encourage community support and participation.

Community consultations — meetings, focus group discussions — are essential in getting community perspectives and knowledge including resource-use patterns, and substrate type.

3. Mapping

Mapping will provide information on resource, and resource-use of the reforestation site.

It also determines the substrate type and the availability of local sources of seedlings, which is vital in considering the particular species to be used and avoiding inappropriate substrate types and sites.

How to do mapping

From a topographic map, develop a base map that will feature the proposed reforestation site. The geo-political boundaries (e.g. barangay boundary), major establishments (e.g. residential areas, roads), and coastal features (e.g. shoreline, reef flat) should be clearly delineated from the base map. Fishers or gleaners familiar with the site could help in the authentication of the map.

Ask the community to delineate the spatial distribution of different resources and resource-uses, and the substrate-type. Whenever applicable, also identify and locate the distribution of natural mangrove trees.

Also ask the community about the water current profile of the site to avoid inappropriate areas, like those exposed to strong tidal actions. The resulting map should identify the appropriate species and delineate the planting site.

4. Site and Species Selection

Determining what species to plant is based on the bio-physical characteristics of the site (e.g. substrate type, tidal inundation regime).

The selection of appropriate mangrove species [refer to Table 3] is generally determined by three factors in decreasing order of importance: the mangrove species indigenous to the reforestation site; availability of seeds or propagules; and objective of the reforestation program .

Table 3. Zonation of Mangroves in the Philippines *(Agaloos, 1994)*

Zone	Tidal inundation regime	Soil types	Common mangrove species occurring naturally	Species to be planted
Seaward	Daily, including neap tides	Coral rubble, sandy, sandy loam	*Avicennia marina* (bungalon); *Sonneratia alba* (pagatpat); *Rhizophora stylosa* (bakauan bato); *R. Apiculata* (bakauan lalaki)	*Rhizophora stylosa* (coral rubble or sand) *R. apiculata*
Middle	Daily, except during neap tides	Silty to silty clay	*Avicennia alba* (bungalon puti); *A. officinalis* (api-api); *Rhizophora apiculata* (bakauan lalaki); *R. mucronata* (bakauan babae); *Aegiceras floridum* (saging-saging); *A. corniculatium* (busain); *Bruguiera cylindrica* (pototan lalaki), *B. gymnorrhiza* (busain)	*Rhizophora apiculata* (sandy loam, silty) *R. mucronata* (silty clay) *Ceriops tagal* (silty to silty clay)
Landward	Inundated only during spring tides	Silty to silty clay to clay	*Bruguiera sexangula* (pototan); *Ceriops tagal* (tangal); *C. decandra* (malatangal); *Excoecaria agallocha* (buta-buta); *Lumnitzera racemosa* (kulasi); *Nypa fruticans* (nipa)	*Ceriops tagal* (silty to silty clay) *Nypa frutican* (silty to silty clay, only where there is freshwater intrusion)
Riverine: subdivided rivermouth and upstream forebank and backbank	Variable inundation brackish/ freshwater influence	Sandy to silty clay	Rivermouth: *Avicennia marina; A. officinalis; Aegiceras floridum* (saging-saging); *A. corniculatum; Camplostemon philippinensis; Rhizophora mucronata; R. apiculata; R. stylosa;* Upstream: *Avicennia alba; A. officinalis; Aegiceras floridum; A. corniculatum; Bruguiera cylindrica; B. gymnorhiza; B. parviflora; Camplostemon philippinensis; Excoecaria agallocha; Heritiera littoralis; Nypa fruticans; Rhizophora mucronata; R. apiculata*	*Rhizophora stylosa* (sandy, rivermouth) *R. apiculata* (silty to silty clay, rivermouth and upstream backbank) *R. mucronata* (silty to silty clay, rivermouth and upstream backbank) *Nypa fruticans* (silty to silty clay, brackish water)

5. Collection of Seedlings/ Propagules

Collection of seedlings and propagules depends on the accessibility of mature trees. Ideally, the seeds or propagules should be collected from the healthy trees with well-developed height, diameter, and crown [refer to Table 4].

Mangrove trees flower and bear fertile seeds at various times throughout the year, depending on location. It is important to carefully observe flowering and fruiting times of the selected species to determine the best time for collection.

Action plan for the collection of seedlings/propagules

When to collect seedlings/propagules? [refer to Table 6]

Who will collect the seedlings/propagules?

After collecting the seedlings/propagules, will it be directly planted or grown in a nursery?

Mangrove Species		Condition for Collection
Saging-saging	P*	Fruits become lightly yellowish to reddish brown upon maturity
Api-api, piapi, bungalon,	P*	Seed coat changes from green to light yellow. Seed coat becomes wrinkly and oftentimes opens
Busain, pototan and pototan lalaki	P*	Tip of the hypocotyl changes from green to brown
Tangal	P*	Ring-like mark immediately below the cap of the propagule and yellow line approximately I-2cm from top of the propagule
Nipa	S**	Seeds change from light brown to dark brown upon maturity and turns lustrous to dull
Tabigi	S**	Fruit changes from light brown to dark brown upon maturity
Busain group	P*	Presence of ring-like mark (abscission layer) below the pericarp or cap (up to cm wide)
Bakauan and *Tangal* group	P*	No ring-like mark; green propagule turns brownish/bronze and drops without the pericarp or carp
Pagatpat	S**	Dark green or yellowish fruits sometimes with cracks
Pagatpat baye and *pedada*	S**	Fruits turn shiny or yellowish and soft
Tabigi group	S**	Green fruits turn to brown with compartment becoming more prominent

* Propagule(s)
** Seed(s)

Table 4. Characteristics of Ripe Seeds or Propagules *(Field, 1996)*

Seeds or propagules can be collected from the tree or from the ground beneath the tree. When collecting from the tree, double check if the propagule is ready for collection. Propagules taken from beneath the tree should have well formed radicals undamaged by insects.

Extra care must be taken when transporting seeds or propagules over significant distances. To prevent desiccation and preserve their viability, keep propagules in small horizontal bundles covered with banana leaves [refer to Table 4].

Table 5. Best Collection Times for Selected Mangrove Species
(Palis et. al. 1998)

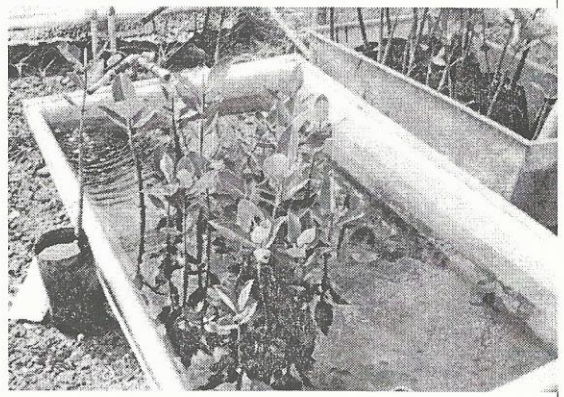
Species	Climate Type* 1	Climate Type 2	Climate Type 3	Climate Type 4
Bakauan bato	Jan & May	Feb - July	Feb, Apr, May	Jan & Feb
Bakauan babae	Oct - Dec	Jan - Aug	Apr - Jun	Jan & Feb
Bakauan lalaki	Aug & Sept	Feb & Mar; Apr - Jun	Mar & Apr	Jan & Mar; May & Jun
Tangal	May	Jan & Feb; May	May; Nov & Dec	**
Busain	Oct - Jan	Jan & Feb; May - Jul	Feb & May	May - Aug
Pototan lalaki	Jan - May; Oct	May	Apr - Jun	**
Api-api	Jan & Feb; May & Jul	Jan & Feb; Jun - Aug	**	Aug
Bungalon	Apr & July; Nov - Dec	Jan; May - Oct	Jan & Mar	Jan - Oct
Pagatpat	Aug - Nov	Jan	Feb - May; Jul	Mar
Tabigi	Aug - Nov	Jan - Aug	Jan - Apr	Mar

** Climate Type refers to rainfall pattern.* ***Type I*** *— two pronounced seasons; dry from November to April, wet the rest of the year.* ***Type 2*** *— no dry season. Very pronounced rainfall in November.* ***Type 3*** *— no pronounced wet or dry season, but relatively dry from November to April .* ***Type 4*** *— rainfall distributed more or less evenly throughout the year.*
*** Species not identified in this climate type*

Nursery Practices

Setting up a nursery is an option when reforestation by direct planting is difficult, or when it is necessary to produce more developed seedlings before planting. Nurseries are useful for mangrove species such as *Sonneratia spp.* and *Avicennia spp.*, which have relatively small seeds. A nursery is normally set up on a sheltered site inundated by spring tide.

There are two nursery techniques proven most useful. For both techniques, regular control of weeds and insect pests is required, and irrigation must be provided if natural water supply is insufficient (Siddiqi et. al. 1993).:



1. Seeds are sown by broadcasting or dibbling in level beds of 1.2 x 1.2m. The beds are separated by 30cm wide and 20cm deep drains.

2. Seeds or propagules are grown in polybags (15cm x 10cm or 15cm x 25cm) containing prepared soil. The polybags are transported directly to the field for planting.

It takes 4 to 6 months to grow out seedlings for transplanting. In this period, the implementing group may form a working group (composed of at least five people) that will take care of the day-to-day management of the nursery. In the early stages, seedlings must be watered twice a day, tapering off to once a day towards the planting season to acclimatize the seedlings.

METHODS of PLANTING

Direct seeding –
propagules are planted directly on the ground. This method is economical and has a high percentage of survival.

Potted seedlings –
used for trees with tiny seeds that are difficult to sow directly in the field. This can be used for specific sites such as open areas with unstable substrates, where there is concern about the early survival of seedlings.

Transplanting of wildlings –
used when there are not enough seeds or propagules. Wildlings should be potted and hardened in the nursery for a month. Wildlings can also be directly planted provided the soil around the roots is still intact. This however requires extra care to protect against root damage.

6. Planting

Place the sharp end of the propagule—at approximately one-third of the length in the soft ground in an upright position of the propagule.

It is suggested that planting should be conducted during low tide at least 4-5 months prior to the onset of the stormy season. This will protect the seedlings from uprooting by ensuring that the roots have sufficient anchorage in the soil column.

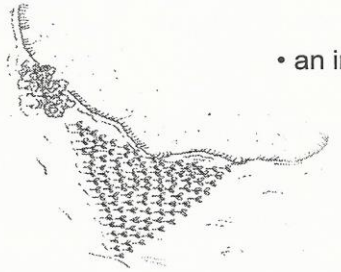
Young seedlings are prone to uprooting as caused by wave and current action. Thus to provide more stability, seedlings have to be tied with a stick. Planting distance varies from 0.5 x 0.5m to 2.0 x 2.0m depending on the selected species and objectives of the program.

Depending on the size of the project and availability of personnel, the implementing group may hire people to assist in the planting activity.

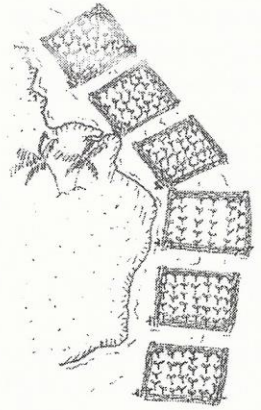
Why install fences and nets? Putting up fences and nets are expensive and laborious. If the purpose is only to protect the area from poachers, then fences and nets are not necessary but instead a regular inspection is needed. In some cases however, fences and nets are needed to reduce the impacts of wave and current actions and in preventing the entry of plant debris that may hamper the growth of the seedlings.

Ideas That Can Be Used in Planting

(modified from Melana et. al. 2000)

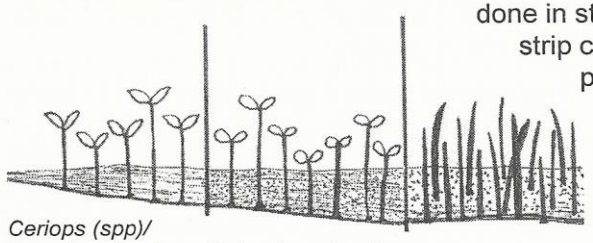


- an inverted V shape with the point of the V facing the sea to deflect wave impact
- triangle formation, with one of the corners of the triangle pointing seaward



- cluster planting. The entire project site is divided into blocks (e.g., 10m x 10m), with each block assigned to an individual. Distance between blocks is also set (e.g., 10m).

- strip planting. With known substrate distribution, planting is done in strips, with each strip corresponding to a particular species.



Ceriops (spp)/ Bruguiera (spp)
reached highest high tide
(clay)

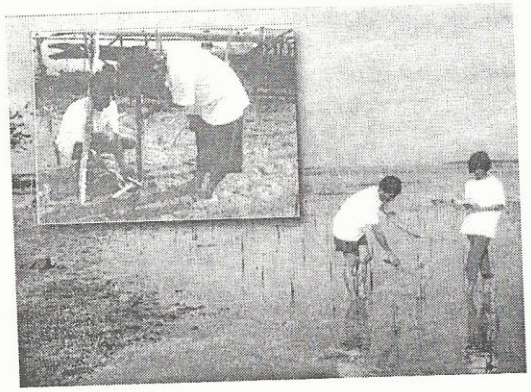
Rhizophora (spp)
With sea water half of the time
(silt/mud/sand)

Avicennia (spp)/ Sonneratia (spp)
Hard substrate w/ thin layer of mud/sand

7. Care and Maintenance

Activities that must be undertaken regularly are cleaning debris, removal of barnacles, repair of fences and nets, and photo documentation. Whenever necessary, pest and disease control should be implemented to protect the plantation against seed and stem borers, leaf defoliators, crabs, barnacles and fungi attack.

Site inspection should also be regularly conducted to guard against poaching or any untoward incidence. Regular patrolling should be ensured because as mangroves develop, an increase in abundance of fishery resources (i.e., shellfish) is observed opening the project site to possible encroachment.

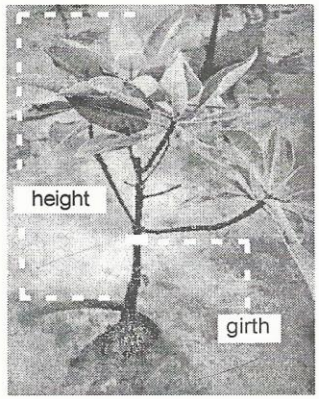


8. Monitoring of Growth and Survival

The monitoring of growth and survival of seedlings is necessary to evaluate the project's progress. Monitoring method needs to be adapted to the capability and skills of the implementing group (IIRR, 1998). An external institution with expertise on mangrove monitoring can provide training on participatory monitoring. Mangrove survival monitoring should be conducted monthly to give ample time to respond to changes, replanting for instance [refer to table below].

Location:	Site:		
Date:	Recorder/Observer:		
Mangrove Health Status	Count		Total Number
	Species 1	Species 2	
Alive			
Unsure			
Remaining Total			
Dead			

Table 6. Monitoring Form for Mangrove Survival *(IIRR, 1998)*



It is suggested that monitoring of growth parameters [refer to Table 7] should be conducted six months after planting. Parameters that need to be monitored are: girth (measured using a caliper 2-3cm just above the first node), plant height (measured using a tape measure from the substrate to the highest tip of the plant), and the number of leaves, branches, roots and nodes (by counting).

Monitoring should be conducted every three months. During the lowest tidal condition, at least 10% of the total planted seedlings, randomly selected, should be monitored. For consistency, each monitored seedling should be properly tagged. In cases where more than one species and substrate-type is present in the site, 5% from each type should be monitored.

Location:			Site:			
Date:			Recorder/Observer:			
Tag #	Height (cm.)	Girth (cm.)	Leaves (count)	Branches (count)	Roots (count)	Nodes (count)

Table 7. Monitoring Form for Mangrove Growth *(IIRR, 1998)*

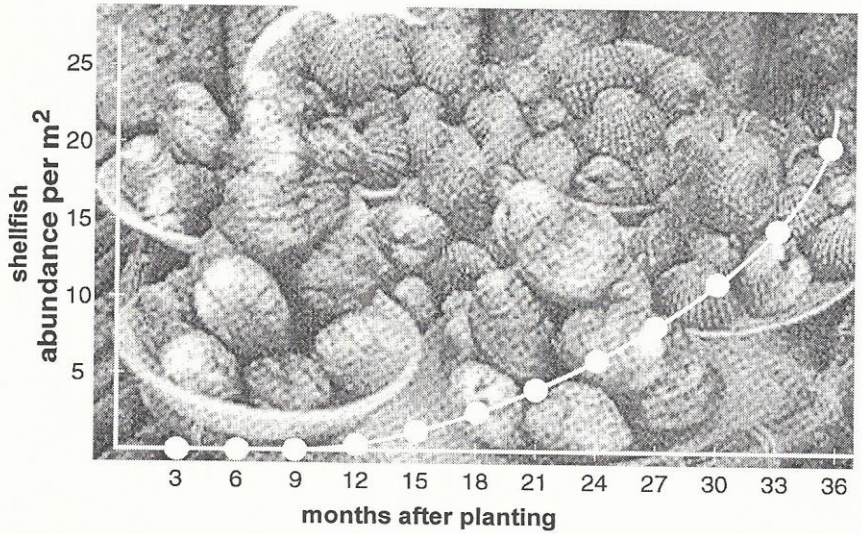
Monitoring of Ecological and Socio-Economic Impacts

The ecological and socio-economic impacts of the mangrove reforestation project [refer to Table 2] have to be periodically evaluated by the implementing group with assistance from the community. A monitoring team composed of at least ten persons should be formed to facilitate the regular conduct of growth and impact monitoring. While there is no standard method yet on impact monitoring, the following can be used:

a Quadrant method: deploy four 2m x 2m quadrant from within and outside the mangrove reforestation site. In each monitoring period (every three months), list and count all the economically

important macro-invertebrates encountered. *Data analysis:* compare the abundance and composition of encountered organisms within and outside the reforestation site for each monitoring period. Note if there is a change in species composition and/or trend with respect to the abundance (e.g. number of shellfish/m²) with time (e.g., Figure 1).

Figure 1. Sample results of monitoring data on abundance of shellfish over time



b Catch monitoring: conducted monthly, this method evaluates the impact of mangrove reforestation in fish catch as a function of time outside the reforestation site. Monitoring forms [refer to table below] should be distributed to at least 10% of the community known to fish in the area.

Name:					
Village:					
Date	Gear	Caught Fish	Fishing Ground	Fishing Time (hour)	Catch (kgs)

Table 8. Sample Catch Monitoring Form

9. Maintaining and Sustaining Activities

The management of mangrove reforestation project is a tedious task and requires financial resources from the implementing group. Since the ecological and socio-economic impacts of the project are not immediately apparent, the interests of the community to manage the project need to be sustained.

Sustaining activities include conducting periodic status reporting to the community, monitoring and evaluation, and refinement of the management plan. An indicative level of performance—what percentage has been accomplished [refer to Table 2]—should be identified in each project evaluation session.

The implementing institution should also be trained to formulate budget proposals, and submit it to appropriate funding institution, that will cover maintenance and operational costs. Networking with other institutions engaged in mangrove reforestation will facilitate exchange of experiences and lessons. Possible venues for networking are seminar-workshops and exposure trips.

Causes of Failure of Mangrove Reforestation Program in the Philippines

(adapted from Fortes, 1995)

Technical/Bio-physical

- the project is too large in scope that the implementing institution or community is unable to sustain the management
- failure to recognize site-specific factors (shelter from wind and wave action, tides, currents)
- damage by floating debris
- pests such as barnacles, oysters, crabs, moths
- young seedlings are subject to grazing
- origin of the seeds/propagules are unknown (constraints to acclimatization)
- seedlings are not matured
- planting sites are improperly selected

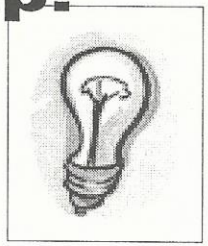
Management-related

- frequent reshuffling of project personnel from the implementing institution
- delayed/untimely release of funds
- lack of tools, supplies, materials
- lack of incentives and disincentives for the implementing institution and the community
- lack of financial and technical support from government agencies, NGOs and academe

Social Causes

- illegal cutting/gathering of mangroves
- encroachment
- ignorance of the existence of the project
- vandalism
- destruction by domestic animals
- lack of appreciation for resource management
- lack of livelihood opportunities

tip!



Factors for Success
(adapted from Fortes, 1995)

- the size and location of the mangrove reforestation site should be manageable based on the capability of the implementing group to help ensure sustained management
- foster multi-sectoral collaboration to provide complementation of activities among the implementing group, community members, barangay council, municipal government, DENR and other government agencies, NGOs, academe, etc.
- be open to other resource management options (e.g. mariculture) and livelihood development projects that could make the project financially self-sustaining
- facilitate community mobilization and capability building activities (e.g. environmental education session, training) to prepare the community in the management of the project
- promote CRM advocacy in the area so that the community will be mobilized to do mangrove reforestation

Module 3

Community-Based Mangrove Forest Management Agreement (CBMFMA)

What is CBMFMA?

CBMFMA is a production-sharing agreement entered into by a community and the government to develop, utilize, manage and conserve a specific portion of the forestland, consistent with the principles of sustainable development and pursuant to a Community Resource Management Framework or CRMF (DAO 96-29, DENR).

It is a policy of building partnership between people and the government for the management and rehabilitation of mangrove forests. CBMFMA is awarded only to organized communities. It integrates all tenurial instruments issued by the DENR prior to 1996 such as Mangrove Stewardship Agreement (MSA) and the Certificate of Stewardship

Contract (CSC) of the Integrated Social Forestry Program (ISFP) of the DENR.

Why CBMFMA?

CBMFMA promotes a development, people- and service- oriented approach in mangrove forest management through community empowerment, to "put people first so that sustainable mangrove forest management will follow." CBMFMA believes that when communities in and adjacent to mangrove forests commit themselves to being responsible stewards, mangrove forest management will be effective and sustainable.

Who may apply for CBMFM?

- mangrove dependents or users
- fisher associations or cooperatives
- traditional claimants
- local government units (LGUs) including barangays and municipalities

What are the general steps for CBMFM application?

(adapted from DENR 1998a and DENR 1998b)

1. Form a People's Organization (PO) if not yet present

The process of forming a PO (composed of at least ten residents)

Objectives of CBMFMA

(DENR Primer, undated)

- identify, train, and orient traditional mangrove users and other dependents of coastal resources in effective community-based management
- preserve the remaining mangrove forests through an effective protection and management scheme
- provide access and economic opportunities to organized coastal communities so that they will benefit from mangrove resources
- empower coastal communities by assisting them to organize and manage the coastal resources
- gradually transfer the protection and management of mangrove forests from DENR to organized communities with the assistance of NGOs and DENR
- promote non-forest-based and non-invasive sea farming livelihood schemes in coastal areas
- accelerate rehabilitation of open and denuded mangrove areas through reforestation, assisted natural regeneration, enrichment planting and other schemes
- expand and develop existing mangrove forests to provide for the increasing demand for mangrove products and sustain the production of goods and services derived from mangrove resources

Visions of CBMFMA

- for mangrove forests to be managed, developed, and conserved sustainably
- for an organized coastal community to stand on its own as a resource manager, protector and developer of the mangrove forests for their sustainable benefits
- for coastal communities to improve their socio-economic condition

Benefits of a CBMFMA holder

- security of tenure on the use of mangrove resources
- training on mangrove-based and related livelihood activities
- enhanced skills on mangrove resource rehabilitation and conservation
- leadership skills on community building, resource management and income generation
- improved environmental and socio-economic conditions (due to possible livelihood activities that may be conducted within the CBMFMA area)

Additional Benefits of a CBMFM holder

- exemption from paying rent for use of the area
- exemption from paying forest charges on timber and non-timber products harvested from plantations
- consulted on all government projects to be implemented in the area
- preferential access by the DENR to available assistance
- receive all income and proceeds from the use of forest resources within the area
- enter into agreements or contracts

may take a long time depending on the diversity of interests of the target groups and community dynamics. However, it is important to devote time and effort in facilitating the formulation of common set of goals and objectives among members.

These goals and objectives may later serve as motivating factor for the members to sustain the management of the project. The PO should be registered in the Department of Labor and Employment (DOLE) or Cooperative Development Authority (CDA) or the Securities and Exchange Commission (SEC). A year after registration, the PO should file accreditation with the municipal government. As an accredited organization, the PO may be coordinated with and benefit from the coastal management programs of the municipal government.

After the PO formation, members should be mobilized and exposed to capability-building trainings (e.g. heightening of environmental education and enhancing resource management skills) to prepare them for the implementation of mangrove reforestation. This way, the PO develops harmonious relationships among members, which could guide them in sustaining the management of the project.

The PO should conduct pilot-testing prior to the actual implementation of the mangrove reforestation. It could further help them systematize the conduct of management activities

based on experience, and identify possible causes of constraints.

2. Determine if the PO wants to apply for a CBMFMA

A one-day orientation seminar, to be facilitated by an external agency (e.g., NGO, academic institutions) or DENR representatives, is important for the PO to evaluate the features and provisions of CBMFMA. The orientation-seminar should discuss (a) CBMFMA as a program; (b) features, principles and scope of CBMFM; (c) who can participate; (d) the concept of the DENR/LGU/PO partnership and their respective roles in CBMFMA; (e) application process; and (f) benefits of a CBMFMA holder.

Through a series of meetings, clarify issues and/or concerns with the PO to help them decide if they will apply or not for CBMFMA. The PO can then send a written request for assistance from the DENR. Otherwise, the PO (perhaps with assistance to an external agency) could proceed with the next steps.

3. Identify and locate the proposed CBMFMA area

Prepare a map (i.e. similar to resource- and resource-use map in Module 2) indicating the extent and coverage of the proposed CBMFMA area. Remember to consider the appropriate site and substrate type for the desired reforestation species [refer to Table 3] if the area will still undergo reforestation prior to the CBMFMA application.

4. Gaining community support

It is important for the PO to gain community support to foster multi-sectoral collaboration and have a possible complementation of activities in the future. It is advisable that the PO launch a series of information and education campaigns as well as community consultations prior to the application for CBMFMA. These sessions could also provide an opportunity for PO and community members to agree on the actual extent and location of the proposed CBMFMA area.

5. Submission of CBMFMA application to CENRO

A resolution from the PO indicating their willingness to apply in the

CBMFM Program of the DENR should be submitted to the barangay council and the municipal council for the respective endorsements. It is important to gain support from the barangay council and the municipal government early in the application process to tap possible logistical and manpower support in the CBMFM implementation. The endorsements should be included in the application letter of the PO.

However, in areas where either or both the barangay council or the municipal government have limited interests on such application, the PO can directly apply to the Community Environment and Natural Resources Office (CENRO). Documents needed in the application are: application letter addressed to the CENRO indicating the willingness of the PO to apply in the CBMFMA, map showing the proposed CBMFMA area, a copy of the PO certificate of registration, and a list of the officers and members of the PO including their addresses.

6. Evaluation by the CENRO

Activities outlined in this section are intended for POs (without assistance from an external agency) in the application process. If the DENR is assisting the PO, ocular inspection is conducted by the CENRO together with the PO in step #3, and therefore should skip this step.

Otherwise, after receiving the CBMFMA application the CENRO will do an ocular inspection to evaluate the viability of the area and prepare the map. The CENRO will then review the application and draft a CBMFMA in consultation with the PO. The consultation will cover discussions of the terms and conditions of the CBMFMA, including the

Area	Recommending Approval	Final Approval
<5,000 has.	CENRO	PENRO
5,000 – 15,000 has.	PENRO	DENR - Regional Executive Director (DENR - RED)
15,000 – 30,000 has.	DENR - RED	DENR - Undersecretary for Field Operations (DENR – UFO)
>30,000 has	DENR - UFO	DENR – Secretary

Responsibilities of the PO

- participate in site identification and ocular inspections
- designate the area according to use, and allocate and enforce natural resource rights
- prepare and implement CRMF, Annual Work Plan/Resource Use Plan for the area
- develop and implement benefit-sharing scheme among its members
- protect, rehabilitate and conserve the natural resources in the CBMFMA area, and assist the government in the protection of adjacent mangrove forests
- develop and enforce policies on the rights and responsibilities of PO members and officers
- develop mechanisms for addressing conflicts, including rules, regulations and sanctions regarding mangrove forests use and protection
- be transparent, promote participatory management and consensus-building
- undertake other responsibilities agreed to in CBMFMA

PO incentives and responsibilities.

After the review, the application will be forwarded to the Provincial Environment and Natural Resources Office (PENRO) for approval by the PENR Officer, or sent back to the PO if refinements are required. It is suggested that the PO conduct periodic follow-up on the status of the application to the CENRO, PENRO and regional office of the DENR to help expedite the granting of the CBMFMA.

7. Approval of the CBMFMA

Awarding of the CBMFMA is usually held during a formal ceremony attended by the DENR personnel, PO members, barangay officials, municipal government officials and the community members. The ceremony need not be expensive. It is intended only to announce that the government is officially granting the CBMFMA. The ceremony may also provide opportunity for the PO to seek assistance and compliance from community members.

8. Work requirements under a CBMFMA

The PO should prepare the Community Resource Management Framework (CRMF) and the Annual Work Plan/ Resource Use Plan (AWP/RUP) with assistance from either DENR or the assisting external agency. These

documents need not be long or complicated. It is intended to provide guidance and understanding for both the PO and the DENR for the detailed activities every year.

The CRMF contains the PO's Vision-Mission-Goal (VMG); summary of situation analysis; guiding principles in plan preparation; indicative community resource development and use plans; internal management agreements including benefit sharing among members; external support needed and internal monitoring and evaluation system.

The CRMF is submitted at the start of the CBMFMA and may be refined if there are significant changes. The CENRO should evaluate the CRMF within 30 days of submission. If not, the plan is considered approved.

Important Considerations:

Despite its interesting features, the CBMFMA also has some concerns that may pose possible constraints in its future implementation. Such as—

- possible jurisdictional conflict between DENR and LGU
- resource-use conflict between the implementing group and other non-members in the community who are mangrove-dependent
- conflicting ideas on resource-use among members of the implementing group

AWP/RUP contains the management and utilization plan for each specific resource covering a specific area of the CBMFMA, and time period to be prepared. The DENR shall conduct the resource inventory. The accepted RUP serves as permit for the PO to utilize the resource.

The annual work plan indicates the specific targets for the year for utilization (based on RUP), resource development and protection, organizational strengthening, and enterprise development. The PO is required to file an AWP each year with the LGU and the DENR. The CENRO should evaluate the AWP within 30 days of submission. If not, the plan is considered approved.

Appendix:
List of Local Names and Corresponding Scientific Names of Mangrove Species

LOCAL NAME	SCIENTIFIC NAME
Api-api	*Avicennia officinalis*
Bakauan babae	*Rhizophora mucronata*
Bakauan bato	*Rhizophora stylosa*
Bakauan lalaki	*Rhizophora apiculata*
Bakauan	*Rhizophora spp.*
Bungalon puti	*Avicennia alba*
Bungalon	*Avicennia marina*
Busain	*Bruguiera gymnorrhiza*
Buta-buta	*Excoercia agallocha*
Diluario	*Acanthus ebractcatus*
Dungon-lati	*Heritiera littoralis*
Kulasi	*Lumnitzera racemosa*
Lagolo	*Acrostichum aureum*
Langarai	*Bruguiera parviflora*
Nilad	*Scyphiphora hydrophyllacea*
Nipa	*Nypa fruticans*
Pagatpat	*Sonneratia alba* (Gedabu)
Pagatpat baye	*Sonneratia ovata*
Pedada	*Sonneratia caseolaris*
Piapi	*Avicennia lanata*
Pototan lalaki	*Bruguiera cylindrica*
Pototan	*Bruguiera sexangula*
Saging-saging	*Aegiceras corniculatum*
Tabau	*Lumnitzera littoria*
Tabigi	*Xylocarpus granatum*
Tangal	*Ceriops tagal*
Tingloy	*Acanthus ilicifolius*

Suggested references for identifying mangrove species:

- Calumpong, H.P. and E.G. Meñez, 1997. Field guide to mangroves, seagrasses and algae of the Philippines.
- Zamora, P.M., 1995. Diversity of flora in the Philippine mangrove ecosystems.

Glossary

estuarine – semi-enclosed coastal embayment where fresh and seawater meet and mix

lee side – side of an island or reef protected from winds and waves

mangrove – flowering terrestrial plant that has the ability to grow in salt and brackish water

mangrove forest – a type of forest growing along tidal mudflats and along shallow water coastal areas extending inland along rivers, streams and their tributaries

mangrove reforestation – a resource management option used to rehabilitate or restore the mangrove forest

mapping – process of plotting the spatial location of resources/ resource-uses, substrate-type in a cartographic map to determine the appropriate species and viable mangrove reforestation site

monitoring – process of determining changes and improvements in mangrove growth and survival as well as the ecological and socio-economic impacts of mangrove reforestation

nursery – place for raising mangrove seedlings until they are ready for planting

pneumatophores – extension of shallow roots used to receive oxygen in the anoxic mud

propagules – germinating seeds of the mangroves, belonging to the Family *Rhizoporaceae,* while still attached to the mother tree

wildlings – seeds/propagules that germinate and grow naturally beneath the mangrove trees

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The International Development Research Centre (IDRC)-Canada, which sponsored the CBCRMP, initiated mangrove reforestation and other coastal resources management projects in Bolinao, Pangasinan. Funding was graciously provided by The Royal Netherlands Embassy.

three-year old stand of reforested mangroves

mangrove seedlings grown in nursery

a PO member monitoring the growth of mangrove seedlings

Enhancing Community Participation in Fishery Resources Management Project
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