

## Establishing a mangrove nursery

Mangroves play an important role in creating habitats for a diverse community of organisms ranging from bacteria and fungi to fishes and mammals. They also provide aesthetic beauty, protect shorelines, reduce the impact of storm surges as well as produce timber, fuelwood, honey and other bee products, organic fertilizers, medicines and livestock feeds. Mangrove trees and shrubs grow in intertidal flats, estuaries and off-shore islands.

Mangrove forests are called "forests of the sea." They are highly productive ecosystems. But they are under continuous threat from man-made activities. The global destruction of mangroves is caused primarily by dumping of garbage and pollutants; clearing for housing, agricultural, and fishpond development; urbanization; resorts and other recreational pursuits.

In the Philippines, mangrove forests have dramatically decreased in area since the start of the century when about 400,000 to 500,000 ha of mangrove stand existed (Brown & Fisher 1918). By 1988, only 139,725 ha were left (NAMRIA 1988). This represents a 70% reduction of the country's total mangrove forest.

The need to reforest is everybody's concern. But first, mangrove nurseries must be established as these serve as sources of planting materials for different mangrove species. Furthermore, nurseries would mean sustainable source of livelihood for coastal communities because of continuous demand for propagules.

Mangrove seedlings are raised in the nurseries for 3 to 5 months depending on the species before out-planting. For the eight species studied and presented here, the cost of production ranges from P422.50 to P1,150.00 per 500 seedlings (1998 prices). There are six insect pests attacking the seedlings and two diseases have been identified. However, control measures have been developed.

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By

**Veronica Sinohin and  
Santiago Baconguis**

*DENR - Ecosystems Research and  
Development Bureau  
College 4031, Laguna*

*E-mail: erdb@laguna.net*



*Mangrove nursery made up of  
bamboo poles with fish net and coconut  
fronds as roofing material*

### Why establish a mangrove nursery?

Many think that mangrove nurseries are not necessary since it is very easy to plant mangroves; that is, stick the propagules in the mud and you have planted one. Probably they are thinking only of the bakauan (*Rhizophora*) species which has long propagules. But there are many mangrove species and most have small seeds or propagules like the "nilad." Besides, there are pests that consume fresh propagules planted on muddy shores.

A nursery is a place where seedlings are raised and handled until they are ready for permanent planting. It is an essential part of reforestation programs and industrial plantations. It can produce healthy planting stocks and subsequently high survival when outplanted.

Another reason for establishing a nursery is protection from pests such as crabs which feed on the cambium layer of the propagules and defoliate newly planted plants. Barnacles also pose a problem. When propagules are planted directly, the barnacles will cling to young plants, strangling them to death. Larger plants raised in the nursery will assure survival since the barnacles could no longer enclose them. As the plants grow larger in diameter, the barnacles fall off.

Mangrove plants are also raised to bigger sizes in the nursery to withstand the inhospitable conditions of denuded or degraded and open coastal environments. -- VS / SB

### Establishing the nursery

Nurseries can be permanent or temporary. Permanent nurseries are established to produce a large number of seedlings for extensive reforestation projects. Although construction is quite expensive, production of good quality seedlings is assured.

Temporary nurseries are appropriate when target planting areas are far from permanent nurseries. They are less expensive to construct, and the seedlings are raised in a vegetation zone with similar conditions to the areas to be planted.

Generally, most mangrove nurseries are temporary to save time, labor and capital.

### Selecting the site

There are a number of factors to be considered in site selection: availability of water, drainage, accessibility, size and topography. Therefore, choose a site that is:

- along streams near a brackishwater source or in areas where freshwater can be easily obtained
- flat for easy accessibility. Be sure to have good drainage to avoid flooding during the rainy season and in times of exceptionally high tide occurrences
- near the target plantation area to minimize handling injury during transport
- large enough for expansion. The size will depend on the target number of seedlings and the kind of species to be raised. A crowded nursery will only result in inferior planting stock

### Nursery construction

The construction of the nursery follows. Temporary mangrove nursery can be constructed using local materials like bamboo poles, coconut fronds and used fish nets. Table 1 presents the approximate cost needed in the construction of a temporary mangrove nursery.

### Preparation of potting materials

Mangroves, being generally viviparous, germinate easily. Once they mature, propagules (of *bakawan*, *malatangal*, *tangal* and *pototan*) start to germinate after falling to the ground.

## Know the Philippine species of mangroves

The Philippine mangrove flora is rich in species composition consisting of 47 "true mangrove" and associated species belonging to 26 families (Melana et al. 1997). True mangrove species are those that strictly grow in the brackishwater or saline environment while associated species may thrive in other habitat types such as the beach forest, and lowland areas. Below is a listing of the most common true mangrove species. - VS/SB

Family	Species	Local name
Avicenniaceae	<i>Avicennia officinalis</i> L.	Api-api
	<i>A. marina</i> (Forsk.) Vierh.	Bungalon
	<i>A. alba</i> Blume	Bungalon-puti
	<i>A. lanata</i> L.	Piapi
	<i>A. eucalyptifolia</i> (Zipp. ex Miq) moldenke	Bungalon-sahing
Bignoniaceae	<i>Dolichandrone spathacea</i>	Tui
Bombacaceae	<i>Camptostemon philippinense</i> (Vidal) Becc.	Gapas-gapas
Combretaceae	<i>Lumnitzera littorea</i> (Jack) Voigt.	Tabau
	<i>L. racemosa</i> Willd.	Kulasi
Euphorbiaceae	<i>Excoecaria agallocha</i> L.	Buta-buta
Lythraceae	<i>Pemphis acidula</i> Forst.	Bantigi
Meliaceae	<i>Xylocarpus granatum</i> Koen	Tabigi
	<i>X. moluccensis</i> (Lamk.) Roem.	Piagau
Myrsinaceae	<i>Aegiceras floridum</i> Roem. & Schult.	Tinduk-tindukan
	<i>A. corniculatum</i> (L) Blanco	Saging-saging
Myrtaceae	<i>Osbornia octodonta</i> F. Muell.	Taualis
Palmae	<i>Nypa fruticans</i> (Thunb.) Wurb.	Nipa
	<i>Oncosperma tigillarum</i> (Jack) Ridl.	Anibong
Rhizophoraceae	<i>Rhizophora apiculata</i> Bl.	Bakawan lalake
	<i>R. mucronata</i> Lank.	Bakawan babae
	<i>R. stylosa</i> Griff.	Bakawan bato/b. bankau
	<i>Ceriops tagal</i> (Perr.) C.B. Robinson	Tangal
	<i>C. decandra</i> (Griff.) Ding Hou	Malatangal
	<i>Bruguiera cylindrica</i> (L.) Bl.	Pototan lalake
	<i>B. gymnorrhiza</i> (L.) Lank.	Busain
	<i>B. parviflora</i> Wight & Arnold ex Griff.	Langarai
	<i>B. sexangula</i> (Lour.) Poir	Pototan
	<i>Scyphiphora hydrophyllacea</i> Gaerthn.	Nilad*
Rubiaceae		
Sonneratiaceae	<i>Sonneratia alba</i> J. Smith	Pagatpat
	<i>S. caseolaris</i> (L) Engl.	Pedada
Sterculiaceae	<i>Heritiera littoralis</i> Dryand. Ex W. Ait.	Dungon-late

\*An important historical mangrove species where Manila (*May Nilad*) got its name.

### REFERENCES

- Melana EE and HI Gonzales. 1997. Field guide to the identification of some mangrove plant species in the Philippines. ERDS-DENR 7. Banilad, Mandaue City  
 ADB/Crown Agents. 1990. Mangrove development project. Feasibility study. Volume 2. Final Report

In nursery practices, pure soil is not recommended because there is a possibility of compaction, thus affecting the roots and root development of the young seedlings. The combination of soil and coconut

coir dust (other porous soil conditioner may be used) is the best potting media in mangrove species propagation. The ratio is 2:1, soil-to-coconut coir dust. The latter pro-



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vides aeration and serves as fertilizer to the seedlings when decomposed.

To prepare the potting media:

- collect soil (garden type) within the vicinity of the nursery
- screen the soil to exclude plant debris, stone and other unnecessary materials
- mix the soil and coconut coir dust in 2:1 ratio and place in appropriate plastic bag [e.g., black polyethylene (PE) bags]. Table 2 shows the recommended sizes of potting bags

### Seed collection

#### Time and location

Collect seeds or propagules of different mangrove species in highly diversified mangrove areas like Pagbilao, Quezon; San Juan, Batangas and in Ulugan Bay, Macarascas, Puerto Princesa, Palawan.

Generally, all mangroves flower and bear fertile seeds and propagules every year. Collect mature seeds or propagules while they are still attached to the mother tree to ensure high percentage of germination. Table 3 shows the different collection areas and fruiting season in south central Luzon.

#### Seed transport

Transport collected seeds under cool and moist conditions since sunlight and heat can cause low viability. This is especially true for *bakauan* which has larger propagules. Protect the propagules by retaining the pericarp and covering it with banana or coconut leaves. It is also advisable to bundle the propagules in 50s or 100s for easy transport. *Malat*

**TABLE 1** Estimated cost for the construction of a 500 m<sup>2</sup> mangrove nursery

Materials	Quantity	Cost (P)*
Bamboo poles	70 pieces	3,318.00
Coconut fronds (and hauling)	200 pieces	1,580.00
Fish net (used)	9 rolls	13,935.00
G.I. wire	5 kilos	276.50
Labor	3 persons	3,555.00
<b>TOTAL</b>		<b>22,665.50</b>

\*Costs are adjusted to 1998 prices, 1 US\$~P39.50. For bamboo poles, 50 pieces were used for the post; 20 pieces were split as rafters for roofing

**TABLE 2** Recommended sizes of potting bags

Mangroves	Bag size
Bakauan babae	7" x 11"
Bakauan lalaki	6" x 10"
Bakauan bangkau	6" x 10"
Talisai	6" x 10"
Dungon-late	6" x 10"
Api-api	6" x 10"
Bungalon	6" x 10"
Pagatpat	6" x 10"
Tangkal	5" x 8"
Malatanggal	4" x 6"
Saging-saging	4" x 6"
Pototan lalaki	4" x 6"
Kulasi	4" x 6"
Nilad	4" x 6"

*tangkal, tangal, saging-saging* and other mangrove species having small propagules can easily be placed in moist containers such as jute sack.

In case of wildlings, always make sure that the roots are intact. Transported wildlings should be placed in jute sacks to protect them from excessive heat and evaporation. Place the wildlings in potted media right away to prevent drying.

#### Seed storage

It is better to keep unpotted propagules/seeds for no more than two weeks. Always



Mixture of soil and coconut coir dust as potting media in mangrove seedling production



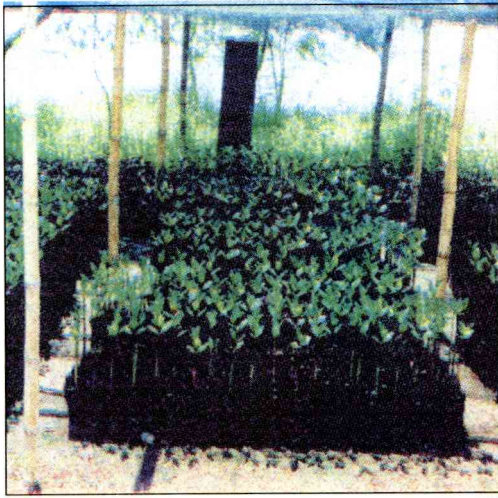
Bundling bakauan propagules in 50s or 100s makes transport easy

make sure that potting materials are prepared first to avoid long storage. If this is not feasible, or when potting has to be continued the next day, restore the seeds or propagules in their jute sacks and keep them in a cool, dry place.

### Seed sowing

Sow the seeds or propagules in appropriate bags and place in shaded area. Here are some pointers:

- water the potting media prior to sowing
- sow the seed or propagule carefully. Burrow one-third of the propagules in case of *bakauan, tangal, malatanggal* and other similar species. In case of *bungalon, api-api, dungon-late, talisai* and other similar species, insert the seeds in plastic bags and place pulverized potting media over the seeds
- raise potted wildlings in the nursery for 30-45 days before outplanting
- water the seeds or propagules after sowing
- group the potted seeds or propagules by species
- label carefully by species for easy identification



Propagules of bakauan bato potted in the nursery



Coconut fronds or kayakas can shade the growing mangroves very well

**TABLE 3** Places of collection and fruiting season of different mangrove and beach species in south central Luzon

Places of collection	Species	Fruiting season
Pagbilao, Quezon	Malatagal	April-July
	Bungalon	June-July
	Api-api	June-July
	Nilad	May-June
	Dungon-late	April-May
	Talisai	April-May
Unisan, Quezon	Nilad	May-June
	Pototan lalaki	May-July
	Saging-saging	June-July
	Bungalon	June-July
	Api-api	June-July
	Malatagal	May-July
Matandang Sabang, Catanauan, Quezon*	Bakauan lalaki	Year round
	Bakauan babae	Year round
	Pagatpat	June-July
	Pototan lalaki	May-July
Catmon, San Juan, Batangas	Tangal	May-July
	Malatagal	May-July
	Pototan lalaki	May-July
	Bungalon	June-July
Nagsaulay, San Juan, Batangas	Malatagal	May-July
	Tangal	May-July
	Bakauan babae	Year round
	Bakauan lalaki	Year round
Parañaque/Las Piñas**	Bakauan lalaki	Year round
	Bakauan bato	Year round
	Bakauan babae	Year round
	Pagatpat	July-August
	Bungalon	June-July
	Pototan lalaki	June-July

\*ERDB aquasilviculture project site

\*\*ERDB coastal road rehabilitation project site

#### Protection from pests and stray animals

Fence the nursery with bamboo and fish net. Conduct regular inspection of the seedlings to prevent any outbreak of pest infestation. Table 4 presents the different insect pests and diseases attacking mangrove seeds or propagules and seedlings.

#### Hardening

Mangrove seedlings must be "hardened" in the nursery prior to outplanting. This is done to acclimatize the seedlings to the local weather conditions. Conduct hardening operation one to two months before outplanting. Table 5 shows the time for sowing and outplanting.

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### Maintenance and protection

#### Watering

Water the seedlings early in the morning and late afternoon to ensure high survival and better growth. Freshwater and brackishwater are recommended over saltwater because high salinity (above 34 ppt) causes stunting and wilting of the seedlings. The salt accumulated in the surface will seal pore spaces and cause very low infiltration of water, and affect the growth of plants. The seedlings are also prone to the attack of barnacles if submerged during high tide. Streams and deep wells (*balon*) are the best sources of water.

#### Shading

Shading is essential in nursery operation as it protects the seedlings from direct exposure to sunlight and heavy rains. Coconut fronds (*kayakas*) are highly recommended.

#### Weeding

Remove weeds when necessary to prevent competition for soil nutrients.

#### Fertilization

Apply one tablespoon of complete fertilizer (14-14-14) to each seedling 30 days after sowing.



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**TABLE 4** Damage and control for pests/diseases of mangrove propagules and seedlings

	Damage	Control measure
<b>Insect pests</b>		
Tussok moth	larvae or hairy caterpillar feeds on leaves of young seedlings	manual removal and killing of larvae
Seed borer, <i>Poecilips fallax</i>	burrow into propagules and breed on the seedling	exclude propagales with holes
Aphids	suck the nutrients off <i>bakauan</i> seedlings	insecticide spray
Scale insect	suck the nutrients from leaves, causing leaves to curl	insectide spray
Slug caterpillar	defoliation	manual removal of larvae
Bagworm	defoliation	manual removal
<b>Diseases</b>		
Leaf spot	brown spot interferes with photosynthesis; defoliation if severe	removal of infected leaves and burning
<i>Bakauan</i> mosaic	defoliation, interferes with photosynthesis	removal and burning of infected seedlings

**TABLE 5** Schedule of sowing and outplanting of selected mangrove/beach species

Species	Sowing	Outplanting	Age of seedlings
Bakauan babae	June	September-October	4-5 months
Bakauan lalaki	June	September-October	4-5 months
Tangal	June	August-September	3-4 months
Malatangal	June	August-September	3-4 months
Saging-Saging	June	August-September	3-4 months
Pototan lalaki	June	August-September	3-4 months
Dungon-late	June	Nov. to December	6-7 months

**Concluding remarks**

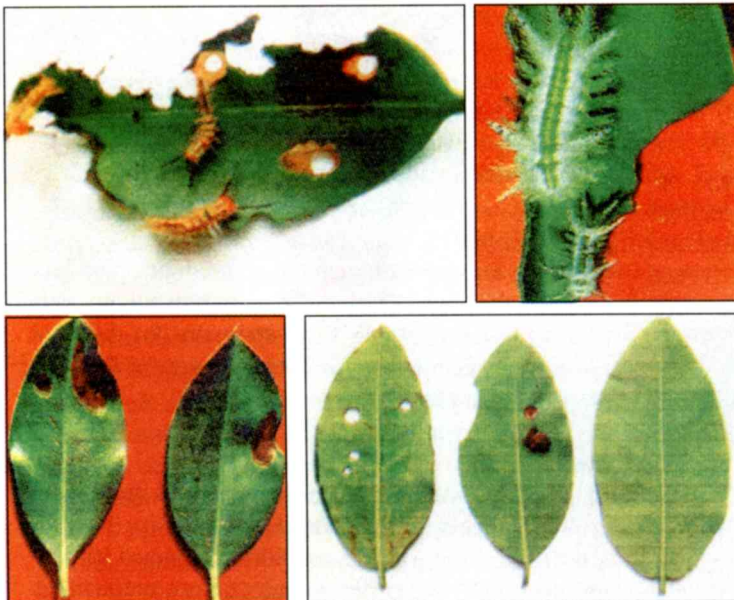
The need to reforest or rehabilitate the denuded mangrove swamps and coastal areas is of national concern. The establishment of mangrove nurseries is in line with government's effort to rehabilitate the coastal and mangrove ecosystems.

The nursery is a place for raising and tending seedlings until they are ready for permanent planting. It plays a very important role in any planting activity as it provides the necessary planting stock for reforestation and other planting operation with high percentage of survival. It also serves as a gene bank for different mangrove species.

Therefore, in areas where it is difficult to plant mangroves and to assure success of mangrove reforestation, a nursery is a must.

**REFERENCES**

- Cabahug DM and CE Llamas. 1989. Research information series on ecosystems (RISE) 1 (8): 1-17  
 Delizo TC. 1964. Forest nursery and plantation handbook of the Philippines. 74 pp.  
 Melana D. 1981. Storage and germination of mangrove species. *Bakauan* 1(4): 2  
 PCARRD. 1991. The Philippines recommends for mangrove production and harvesting. Series No. 74. 96 pp



LEFT, CLOCKWISE *Tussock* moth, slug caterpillar and bagworm feeding on *bakauan*, and the looks of the leaf spot disease