

Mangrove's look-alike species

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Calixto E. Yao

Mangrove swamps are usually avoided because of their muddy soil, foul odor, numerous pneumatophores (*Sonneratias* and *Avicennias*) and prop roots/aerial roots (*Rhizophoras*), and ever presence of niknik and mosquitoes.

These discourage even many foresters who are supposed to appreciate and care for all kinds of forests. Mangrove species are, thus, hardly properly identified, even by people who work in mangrove areas.

During the past decades, when most of our mangroves began to disappear due to overexploitation, interest in this unpopular ecosystem finally grew as indicated by the number of mangrove publications, seminars and workshops that has appeared.

In the 1980's, Central Visayas pioneered mangrove planting under the Mangroveville Project initiated by then Bureau of Forest Development (BFD) Regional Director Marcelino Gulle.

About the same year, the Central Visayas Regional Project (CVRP), a World Bank-assisted project, expanded mangrove reforestation in selected sites in all the provinces of Region 7.

The CVRP later initiated the issuance of contract certificates for the stewardship of mangroves — giving tenurial rights to bona fide fishermen on mangrove areas.

The said tenurial instrument was considered a milestone in empowering the people in the management of natural resources and was officially adopted by the Department of Environment and Natural Resources (DENR) in 1990.

In 1991, the DENR started massive rehabilitation, both in the upland and the mangrove, through the Community-Based Contract Reforestation (CBCR) Program, under the Asian Development Bank (ADB) Loan I. The CBCR is another pro-people initiative of CVRP ultimately adopted by the DENR.

This was followed by the Coastal Environment Program (CEP) in 1994

which also partly focused on mangrove protection/rehabilitation.

In 1996, another DENR program called Community-Based Mangrove Forest Program (CBMFP) was launched with the aim of awarding Community Mangrove Stewardship Agreements (MSAs) in line with the people empowerment program.

In July of the same year, a USAID-assisted program — Coastal Resources Management Program (CRMP), was implemented in Region 7 and other selected regions.

With the increasing interest in mangroves, it is important that mangrove species be properly identified.

Many mangrove species belonging to the same genus are look-alikes. The following descriptions and differentiations of look-alike species can help a lot in their correct identification.

Many of the differentiations used here were adopted from "Mangrove Trees of the Philippines" by S. E. Fernando and J. V. Pancho and "Field Guide to the Identification of Some Marginal Species in the Philippines" by E. Melana and H. I. Gonzales. Some of the descriptions were based on the field observations of the author.

Rhizophora

Bakauan bato or bangkaw (*R. stylosa*) is a small tree that is dominant in Central Visayas, especially in plantations. It is easily recognizable through its curling leaves (leaf margin underside) that turn bright yellow just before falling off.

As its common name implies, it thrives well in sandy and rocky areas. This species was formerly mistakenly identified as bakauan babae (*R. mucronata*) in Central Visayas due to its numerous flowers from a single stalk like the real bakauan babae.

Bakauan lalaki (*R. apiculata*) is a medium-sized tree and can be identified even from a distance due to its reddish terminal bud and pointed apex. Its flowers are limited to two per stalk, with the stalk

shorter than the leaf petioles. Its propagules are dark green, smooth, shiny and roundish tipped with few lenticeis.

Bakauan babae is also a medium-sized tree, easily identifiable through its broad leaves, whitish terminal bud and long propagules (50 - 8 cm). Like bakauan bato, it has numerous flowers per stalk.

Bakauan hybrid is similar to bakauan babae except that it has two to three flowers on short stalks. Found in Bohol, Negros and Cebu, they are very limited in number.

Bruguiera

Genus *Bruguiera* consists of four species divided into two distinct groups: single flower (busaing and pototan) and multiple flower (pototan lalaki and langarai).

Busaing is easily distinguished by its red flower and elongated, cigar-shaped, ribbed propagules while pototan has orange flowers and stubby propagules.

Pototan lalaki has a maximum of three flowers while langarai has five.

The *Bruguiera*s are found landward but busaing is sometimes found seaward associated with pagatap. A tree in Puerto Princesa, Palawan is thriving 10 m seaward.

Ceriops

Ceriops are represented in the country by two species distinguished from each other by size. Tangal is bigger and taller (about 2 m clear bole) with roundish or oval crown. Malatangal is bushy and dwarfed.

Tangal propagules are longer (15 cm), pendulous, olive green to dark brown when mature. Malatangal has shorter (10 cm) propagules, yellowish when mature, pointing to all directions due to the absence of individual petiole.

Ceriops in the Philippines are found landward but tangal is also found seaward associated with pagatap and bungalon.

Xylocarpus

Tabigi and piagao are *Xylocarpus* species found in the Philippines. Tabigi has brown smooth bark with some flakes. Piagao has grayish bark with deep fissures.

Tabigi leaves are even/pinnate, with rounded apex and thickly coriaceous. Its brownish globular fruit contains several angular brown seeds. Piagao leaves are thinner, green, up to four pairs and have acute apex. Its fruit is smaller than that of tabigi; its stem with higher, clear length.

Xylocarpus species in the Philippines are found landward of mangroves and along rivers.

Avicennia

Avicennia, the only genus of family *Avicenniaceae* in the Philippines, is represented by four species: *A. officinalis* (api-api), *A. marina* (bungalon), *A. lanata* (piapi) and *A. alba* (bungalon puti). *Marina* species has three varieties: *resinifera*, *rumphiana* and *intermedia*.

The *marinas* are located seaward while the *officinalis* thrive landward.

Sonneratia

Sonneratia, the only genus of family *Sonneratiaceae* in the Philippines, is represented by: pagatpat (*S. alba*), the most common, pedada (*S. caseolaris*) and pagatpat baye (*S. ovata*), the rarest.

Pagatpat is the biggest (up to 60 cm) and most dominant among the three species. It is found farthest from the shore (up to

70 m from the shoreline). Pagatpat is also good fodder due to its succulent leaves.

The rare *S. ovata* (pagatpat baye) was only recently identified in the country. The author "discovered" it in 1989 in Lapak, Liloan, Marina, Siquijor where it was wrongly identified as pedada since there were only two species listed under *Sonneratia*, then.

The correct identification was established through communication with the National Museum and Fred Vande Vulsse.

The species looks like pagatpat except for its whitish bark, small diameter and shorter height. It is characterized by its shiny big fruit with prominent depression at the base of the style.

Its most distinguishing characteristic is that its sepal curves downward, touching the fruit. Its seeds are angular and small (4 mm) and arranged as in the guava fruit.

Its habitat is at the backward side of the mangrove areas seldom reached by the tide. Its seedlings tested in tidal level areas, however, are thriving well for the last four months. Its fruit is eaten in Iloilo where it is reportedly abundant.

Its seeds easily germinate. Wildlings abound under the canopy if the seeds are not washed out by the tide. The species is reported to be present in Candilay, Uday and Calape along upper riverbanks and in dry upper mangroves.

Pedada is a medium-sized tree found in the landward side of mangroves or river banks. It is easily distinguished from

pagatpat by its longer, smoother and green pneumatophores. Its calyx is flat like *S. ovata* but its sepals are spread at right angle with the fruit.

This species is abundant in Bohol, along the banks of Inabanga River. Some trees grow about 5 m from the bank indicating it can thrive in uplands. Its seeds germinate under the canopy.

Lumnitzera

Genus *Lumnitzera* of family *Myrtaceae* is represented in the Philippines by two species: tabau and kulasi. Tabau is distinguished by its bright red, small flowers, dark green succulent leaves and big cylindrical bole, highly prized as post.

Kulasi is a small branchy tree with white flowers and leaves that are light green and thinner than the tabau.

Tabau thrives landward, where it is seldom reached by the tide. Kulasi also thrives landward but it is reached by the tide more often. In some cases, both species are found together in one site.

Aegiceras

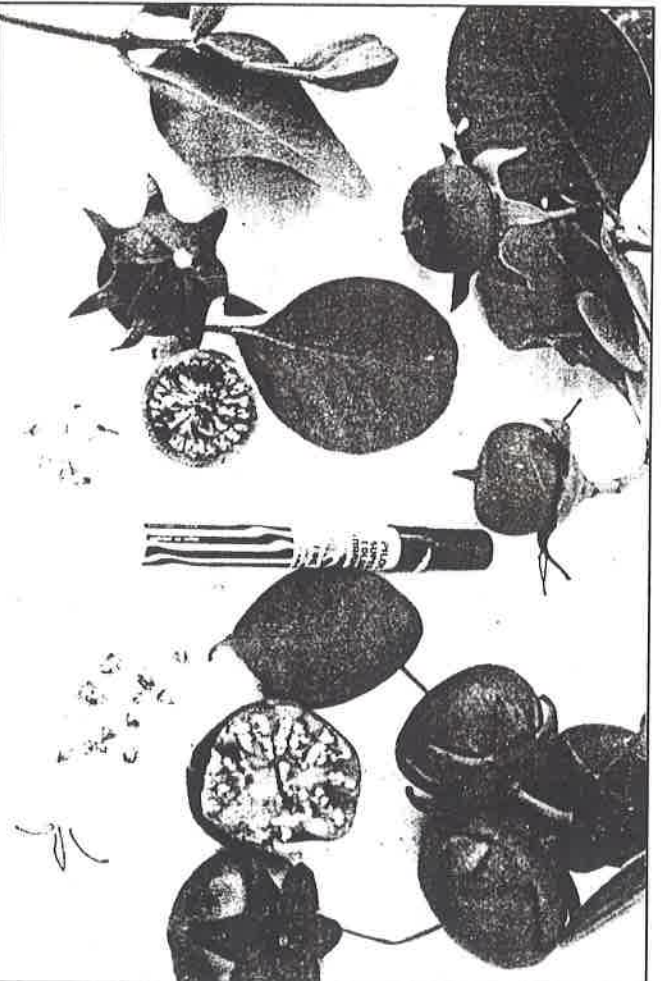
This genus is represented in the Philippines by a pair of look-alike species under the family *Myrsinaceae*. Both are small trees found in the landward side of the mangroves. They are distinguished by their banana bunch-like fruits. Sagingsaging's fruit is almost half-moon, reddish in color while tinduk-tindukan is much smaller (3 cm x 6 cm) and slightly curving.

Readers are encouraged to consult Melana and Gonzales' 1996 Guide Book for more detailed differentiations.

References:

- Fernando, E.S. and J.V. Pancho. 1980. Mangrove trees of the Philippines. Syvatrop. (10:35-54).
- Melana, E.E. and H.I. Gonzales. 1996. Field guide for the identification of some mangrove species in the Philippines. ERDS, DENR-Region 7, Bantlad, Mandaue City.
- Vande Vulsse, F. Personal communication. 1995. USAID Consultant.
- Yao, Calixto E. 1986. "Baracon: biggest bakawan plantation in Central Visayas". CANOPY International. FORI, College, Laguna.
- "Mangrove reforestation in Central Visayas". CANOPY International. FORI, College, Laguna.

MANGROVE LOOK-ALIKES. Pagatpat and *S. ovata* are among the many species of mangrove look-alikes thriving in the Philippines. Above photo shows pagatpat at left with cuplike calyx and sepals turning upward as distinguished from *S. ovata* whose sepals are flattened and attached to the fruit. Note the different seed arrangements. (Photo by C. E. Yao)



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In the second symposium, the notable speaker was Prof. Kazuosh Seki, an anthropology expert from the University of Tsukuba in Japan, who said that sorcery and healing are closely related, that both are social realities in Siquijor.

Interesting statistics came out of the two gatherings. There are a total of 96 shaman or *tambalan* all over the province with the municipality of Maria having the highest number at 23.

But one important output of the workshops and symposia is the identification of the need and important role of plants in healing. One of the issues identified was the fear among the *tambalan* and *hitor* that herbal plants are getting scarce.

In the *tambalan*'s house a day before Good Friday, visitors come from all over the country. They are patients seeking cure, tourists and media, or other faith healers asking to buy the cure-all oil.

During Holy Week at faith healer Indoy's house, the atmosphere is like a fiesta with different groups huddled in the corners of the house, some of them coming from as far as Mindanao, some having attended such rituals for the last 17 years. The kitchen of Nong Indoy, one of the oldest faith healers in Siquijor, buzzes with activity, preparing free meals for some visitors.

In one section of the yard, people gather around a pile of branches or roots of medicinal plants from which are collected

THE BOTANICAL SIDE OF SORCERY

BY CALIXTO E. YAO

While most of Siquijodnons stay home in prayer or in reflection and meditation observing the Holy Week, the houses of the *tambalan* or faith healers are beehives of activity.

As early as Holy Thursday, they prepare the ingredients for the "cure-all oil" which is a concoction from a collection of branches, roots, flowers, fruit chips placed in a bottle. This is usually mixed with vinegar, honeycomb and candles.

The cure-all oil is said to be effective, especially in curing skin diseases. If one herb fails, most of the more than 60 herbs in the concoction probably will succeed.

APRIL 9, 1995

Good Friday. The *Tambalan* themselves do the gathering with their assistants, or buy the *kinilap* (medicinal plants) from the reliable *menangangalap* (gatherers).

The province of Siquijor has always been known as the island of fire and magic, rich in tales about witchcraft or sorcery, but also about healing.

It recently got some publicity through two TV programs, which prompted the Siquijor Island Concerned Association for Progress (SICAP) to organize two symposia to review the merits and demerits of witchcraft as a "come-on" feature of tourism in the island.

Among the guest speakers in the first symposium was Dr. Jaime Licaucó, president of Innermind Development Institute, Msgr. Julio Cortes and Dr. Nell Alcoran who presented statistics on the number and distribution of shamans/*tambalan*.

Some plants are probably used not so much for their chemical composition but for their symbolism

chips. The tiny chips are put in small bottles and filled with the cure-all oil earlier prepared. The herbs used for sorcery and love potions are said to be prepared on Holy Saturday using the same process and ingre-

Some plants are probably used not so much for their chemical composition but for their symbolism. For example, most of the plants used in the love potion or *lunay* have spines and hook-like growths as though they could hold on to something. One of the love-potion plants is the *kawilan*, a vine with hook-like tendrils in the internodes. Or there is the bird's nest ingredient, representing love and production of offspring.

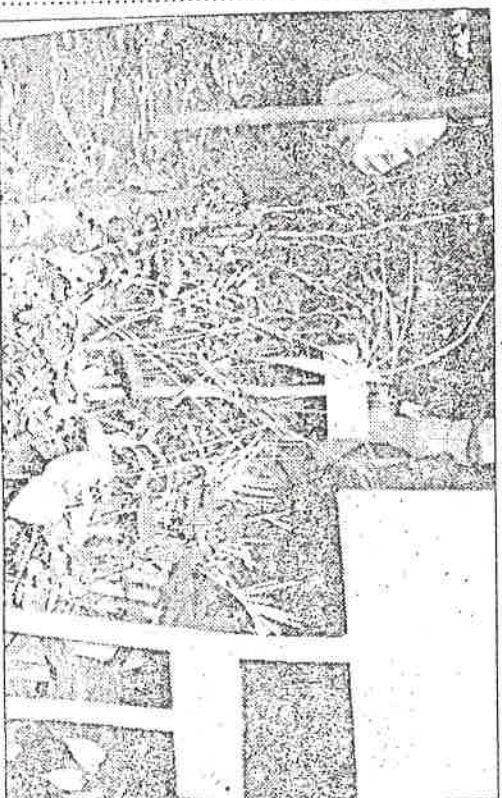
One thing that everybody is sure about is that there are a good number of plants that are used in both healing and sorcery and that some of these plants have now become scarce. There is also an increasing num-

serve as a continuous supply of raw material. It is also seen important by the SICAP in Sigujor that these plant species be chemically analyzed to determine their pharmacological value.

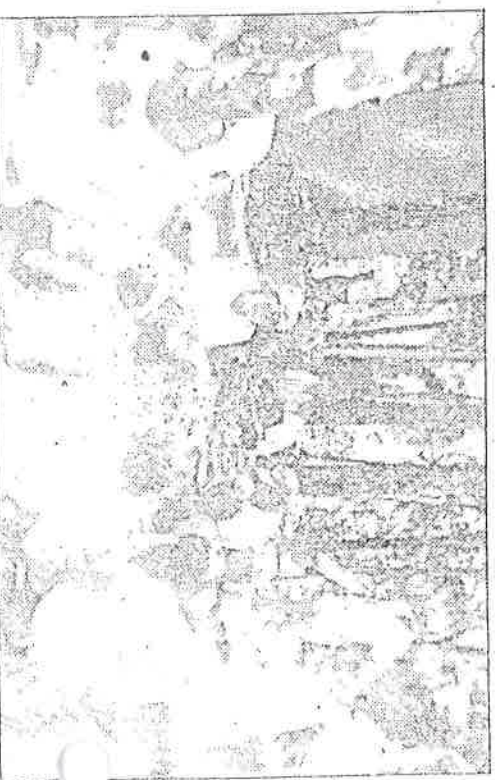
from Ponong gave 37 species while that of San Antonio and Cantabon gave 112 and 120, respectively. The difference in the number and species of *tambalan* depends on his experience and the area where he collects the ingredients.

The Provincial Environment and Natural Resources office (PENRO) in Sigujor has started collecting medicinal plants for the projected plantation.

San Antonio, the town studied by Mager, Julio Cortes for its so-called witchcraft practices, has more of its herbs and shrubs located in open land. In Cantabon, being near the



A chunk of honeycomb is put into the ingredients that make up the cure-all oil (extreme left). The oil-making ritual is attended by many local folk and visitors (above). Included in the preparation are medicinal plants for love potion (left).



Bandiliann Reforestation Project, more tree species are found in a big patch of natural growth.

Of the total list of 34 trees, 40 shrubs, 20 herbs, six grass and 20 vines, 86 are medicinal ingredients while 21 are ingredients of love potions.

The Holy Week rituals, especially the preparation of the cure-all oil, have been attracting more and more visitors to the island of Sigujor. It brings in more business, especially the transportation business, the pension houses and catering. This is one reality that makes many islanders in Sigujor happy for now. **ET**

dients. But the ingredients added to this concoction include sea urchins (*myem*), crown of thorns (*adpags*) and other harmful marine life that represent danger from the sea.

ber of *tambalan* and *mangar-salap*.

And so the symposium participants agreed that it has become imperative to establish a plantation of the species to

Trees for tuition fees: A new concept in reforestation

BY C.E. YAO

The TITF was originally intended for a limited number of pupils, say 50 per hectare so that at least each pupil could have a minimum share of P20,000 in 10 years based on the estimate that one hectare would net P2,000,000 to be divided by landowners and students at 30-70 per cent sharing agreement, respectively.

RATIONALE

The "Trees For Tuition Fees (TITF) Project" started as a come-on slogan (a selling point) in encouraging Private Reforestation in Negros Oriental, as some students at Silliman University are studying out of the proceeds from trees.

When I was transferred to Siquijor on February 1993, the TITF slogan has broadened in its scope and become one of the several projects under the "Greening Siquijor Program" whose objectives are to rehabilitate the devastated private lands and increase land productivity.

Other projects included Showcasing Tree Farm (STF) and Establishment of Forest Nursery in the schools in compliance to Executive Order 113 on massive tree planting.

*Because of the DECS Pocket Forest Program which was in full swing in Siquijor at that time, planting site was a big problem (that even the tennis court was planted to mango) and the great dismay of the club members, the TITF was made as a vehicle to convince landowners near school sites to lease his land to PTA with the pupils, assisted by parents, developing the area into forest plantation with DENR providing planting materials and technical assistance while the Rotary Club of Siquijor donated fertilizers.

OBJECTIVES

To establish Tree Farms near the school under leasehold between landowners and the Parents and Teachers Association (PTA) with the participating pupils as the ultimate beneficiaries.

To give poor students a break to go college

out of the proceeds from trees they have planted.

3. To promote private reforestation/tree farming through students, parents and teachers participations.

The first TITF was implemented at Larena Elementary School through the generosity of Atty. Eugenio Oniclin, Jr., the landowner, and the strong leadership of Mrs. Lee Baduan and Mrs. Edna Duray, Principal and PTA President, respectively.

The Rotary Club of Siquijor facilitated the first TITF by convincing Atty. Oniclin on the merit of TITF; after some press release, on TITF, some landowners have volunteered for the project. By 1994, two additional TITFs were signed 10 lots are under negotiation.

THE MECHANICS

Selection of participants

The TITF was originally intended for a limited number of pupils, say 50 per ha, so that at least each pupil could have a minimum share of P20,000 in 10 years based on the estimate that one ha. would net P2,000,000 to be divided by landowners and students at 30-70 per cent sharing agreement, respectively.

What happened with the first TITF was that participation was not limited. The school was more concerned in meeting their target, requiring all students to plant two trees each, rather than the share from harvest.

Thus 300 pupils participating in the .5 ha. TITF area. Perhaps as bigger area becomes available, ideal number of participant can be worked out.

Selection of TITF participants to be determined by PTA may be based on the following

criteria:

1. Physically fit.
2. Academic standing.
3. Proximity to the site.
4. Parent's income.
5. Interest to go college.

For a bigger representation from the school five pupils from each grade could be tapped to compose the first batch with a total of 30 pupils per hectare. As the grade VI graduate replacement of same number will be selected from the incoming Grade I, to maintain the members at given time.

All the mandays imputed by the student from site preparation to maintenance, pruning thinning and harvesting will be properly corded as same will be the basis of share during harvest. Graduating students, we have an accumulated mandays, depending the number of years he was in.

Net proceeds from the plantation (my share of landowner) will be divided by the number of mandays of all the participating pupils to get the value of one manday. Students with bigger mandays gets a big share.

A participating Grade I pupils will be time for college 10 year time. By their time the plantation will already be harvestable properly managed. His share from TITF will be more than enough for his tuition fees.

EXPECTED INCOME

Based on the growth rate of some fast growing species (*Casahuate*, *A. mangium*) lecture with 200-250 trees as final crops will

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...FOR TUTORIAL...
...from page 27)

age dbh of 40 cm. and 10 m. height could generate at least P2 million at P50,000/ha. In 10 years hence it would be producing 200 mt. of P10,000/ha.

250 trees/ha. you get P2,500,000,000 is a conservative estimate considering you could get more than 200 trees/ha. depending on the soil and management.

arable land (less than 50 per cent slope) leveler could plant agricultural crops in between the trees up to five years with an age income of P6,000,000/ha. (for two crop/year). The amount is already 20 per cent than the income from pure corn plantation (about 2000).

The added bonus with agro-forestry is the growth of trees is about 200 per cent in the first two years compared with monocropping. (Ordinary ring weeding maintenance). This is attributed to the lesser competition from grasses as the former tree/grass soil cultivated more or less.

Additional income may also be generated from intercroppings. During the first thinning at year three or four, trees to be thinned may have much of value, but in the second thinning at year seven or eight when trees to be thinned average 20 cm. dbh, each tree may cost at P500 each for post or mining timber.

With 200 trees cut during second thinning, TTF could generate P200,000,000/ha.

Storage from pruning and thinning which be conducted during summer when there is storage of forage will be a big help to others. For a livestock based province like Iloilo, forage from TTF will surely boost livestock livelihood.

Memorandum of Agreement (MOA)

The present TTF MOA is only between DENR and PTA since DENR participation is limited to providing seedlings/technical assistance. The DENR could probably be included in the MOA if we provide budget for site preparation and inputs with the development of DENR upon harvest of trees. This could be done in case the PTA cannot afford for the same. (Attached is the draft MOA Agreement).

Attached with the MOA is a planting plan which map to be prepared by the DENR. The planting plan will guide the teacher in handling the project, as to what species to plant in a particular terrain, and kind of cultural crop for intercropping.

For seed and maintenance, fertilization and cultural treatment are also indicated in the

Planting Plan

Campanile High School
Trees for Tution Fees Project

Campanile, Iloilo
Total Area: 1.0 ha.

Land Owner: Mrs. Davila yda. de Baray

RATIONALE

The "Pocket Forest Program" of the Department of Education Culture and Sports (DECS) was conceptualized to assist the Department of Environment and Natural Resources (DENR) in the reforestation effort and eventually help solve the problem on environmental degradation.

Another objective of the program is the beautification of the school, restore all wild habitats and self-sufficiency in timber products for the school's need as timber prices increase due to the impending total logging ban and increasing population.

The "Pocket Forest" program has generated interest among teachers and pupils since its implementation last year (1992) but the problem is planting sites. Most of the school campus have a very limited area that only a few trees could be planted.

And in order to plant more trees, seedlings are planted in a very close spacing of 1 x 1 m.

Out of the above problems on planting site the "Trees For Tution Fees" (TTF) project has involved. Under the TTF, the land owners reluctant or non the schools leaves this land to the PTA to be planted with trees from 10-15 years on agreed sharing arrangements with the participating pupils as to primary beneficiaries. Proceeds from the tree harvest may be used for their tuition fees in college.

The TTF will be assisted by NGO, Rotary Club, Department of Agriculture and DENR by providing planting materials, inputs and technical assistance.

Although the said project was conceptualized in Negros Oriental, the first TTF project will be implemented by Larena Central Elementary School, Larena, Siquijor through the generosity of Atty. Eugenio Onilhin, the landowner, the deep commitment of the School principal Mrs. Babilan and her faculty members and of course the initiative of the Rotary Club of Siquijor for sponsoring the TTF.

Forty per cent of the land is flat land and a small hill in the Northern portion.

A creek with flowing clear water serves as a natural boundary in the Western side. Said creek is a bonus for the TTF since the students could water the seedlings during summer.

SITE PREPARATION

The site could be divided into four blocks following the slope to accommodate the following species with assigned block:

1. *Gmelina* — Block I
2. *Neem Tree* — Block II
3. *Eucalyptus camaldulensis* — Block III

4. *Acacia mangium* — Block IV (hill side)

Pluck one to three will be plowed a month before the rainy season, stocked at hill adjacent two weeks before replanting spacing will be 3 x 4 with the 4 m width oriented East-West to intercept more sunlight for the agro crops.

For Block IV, contour planting will be applied using A-frame to determine contour line. Spacing of 3 x 4 will also be followed with agro crops planted following contour. Under intercropping, tree growth performance during the first two to three years is 200 per cent or over compared with the trees not intercropped.

The growth difference is attributed to the absence of nutrients and soil moisture composition from grasses. Another plus is that when you fertilized your intercrop, your trees is subsequently fertilized too.

CONTOUR PLANTING WITH HEDGEROWS

Contour planting using A-frame with 3 m contour interval is strongly recommended to check soil erosion and conserve water as the area is rather still and the soil is highly erodible. Kakawate cuttings will be planted in between row of trees along contour at 1.2 m spacing.

Hedgerows will be pruned every two months or as needed. Pruned leaves will be scattered over the area planted to agro crops to serve as mulch and the twigs

THE AREA

The area is a 1.0 ha farm with few coconuts and

Plantation Establishment

For ease and convenience of the PTA/Students, a planting plan (please see attached plan) will be prepared by CENIC/PTENIC, indicating among others: species, spacing, weeding, site preparation, hole digging, planting, weeding, mulching, fertilization, pruning, thinning and harvesting.

For that area, wider spacing (3 x 4) is recommended so that intercropping could be done up to five years. On sloping areas, contour planting is strongly recommended with narrow cuttings (1 m. spacing) in between to follow contour to serve as hedge. Rows to check soil erosion and run off.

slid evenly along the tree and hedges rows to reinforce the contour barrier.

STAKING/HOLE DIGGING/PLANTING

For alignment, also will be blocked at least no foot width following the 3 x 4 spacing. Planting hole should be at 20 x 20 x 20 cm. nonation to loosen the soil around the root slant.

Hole digging will be done by placing the soil on the other side of the hole and to sub well or the other side.

Planting will be done at the start of the rainy season. Take extra care not to break or polluting soil and damage the root system on removing the plastic bag.

Flap the top soil first in covering the hole before the sub soil in order for the system to be in contact with the top soil. It has high nutrient content through the soil.

Press the soil after the hole is covered to rid of air pockets that could delay drainage system. Root collar must be at the soil level.

FERTILIZATION

It then to be fertilized with 20 grms. of 4-14-14 weeks after planting and three times later for year one. Flap the plastic liner two at 1000 dosage (50 grms.). Fertilizer to be applied in band (half 1), one inch deep and one inch wide on the banding for optimum utilization.

ver the fertilizer with soil to avoid fertilization was being washed out by rain. Fertilizer at the start of the rainy season. Fertilizer at the start of the rainy season. Fertilizer at the start of the rainy season.

Soil cutting will be pruned regularly to avoid overgrowing the trees. Kawawie twigs will be filed along contour as erosion barriers. Fast growing trees like Nene Tree, *Eucalyptus camaldulensis*, *A. mangium* and *Gmelina* are recommended for short rotation. Said species bear fruit in three to five years, thus ensuring seed supply of the DECS and additional income for the students just in case there are seed buyers.

Planting

For alignment, planting site will be staked at least one foot height following the 3 x 4.

Planting hole should be at 20 x 20 x 20 cm. dimension to between the soil around the root system. Hole digging will be done by placing the top soil on the other side of the hole and to the sub soil or the other side.

INTERCROPPING

It has been observed that growth of trees with intercropped agave crops is very much faster, compared to conventional plantation management. This could be attributed to the fact that the agave, round, the seedlings in always clear of vegetation, thus, lesser nutrient competition and the area of the plantation is always cultivated and cleared of weeds.

Moreover, if you apply fertilizer to agave crops that the seedlings are also fertilized through soil moisture movements under ground.

MULCHING

This is done by placing cut grasses over the cultivated area around the seedlings (50 cm diameter) to reduce evaporation and lower soil temperature. The mulching materials also serves as fertilizer upon decomposition. Mulching is critical during summer.

SILVICULTURAL TREATMENT

Pruning is done at year one up by cutting old lower branches to hasten apical dominance or improve height growth.

The nutrient that the other side would have been consumed by the ground branch will now be utilized by the remaining branches. Pruning also induced over shading on agave crops.

On the other hand thinning is done by cutting suppressed and crowded trees to lessen nutrient competition. At the initial spacing of 3 x 4 m. for fast growing species, thinning may be done in four years or a year after the crown canopy stage when competition for light becomes more intensive.

Generally thinning is done at 50 per cent

Replace the top soil first in covering the seedling before the sub soil in order for the root system to be in contact with the top soil which has high nutrient content through the sub soil. After the hole is covered press the soil to get rid of air pockets that could delay drainage the root system. Root collar must be at the ground level.

For sloping areas, contour planting using A-frame within three m. contour interval is strongly recommended to check soil erosion and conserve water as the area is rather stiff and the soil is highly erodible.

Kawawie cuttings will be planted in between rows of trees along contour at 1/2 m. spacing. Hedgerows will be pruned every two months or as need arises.

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level intensify during the first thinning and within 50 percent on the second thinning at year eight with final crop target of only 200-250 tons/ha. For the TFF, progress slow thinning will be done as need arises, as intense light competition become apparent, or better yet as availability of market, especially from the second thinning when substantial volume will be harvested.

For optimum growth, wood quality, and early investment return at the earliest possible time, subjected appropriate silvicultural treatment will be conducted in the plantation. Pruning could be done at six months or one year, provided that it should not exceed 50 percent of the live crown, otherwise phytocytotoxic process is adversely affected. Start pruning from the lower branches, as old leaves in the lower branches has lesser use for the trees.

The spacing of 3 x 4 or 836 trees start thinning of 30 to 40 percent level at year three to four after one two years of canopy closure stage, then repeat thinning target of 200 to 500 trees/ha, as final crops at year 10 or 12 for sawn timber such as Gmelina, mangium and nene tree.

MARKETING

For fast growing species such as mangium, nene tree, burning, Eucalyptus, they will be ready for harvest in 10 to 15 years, while the rest will harvest 20 years later. mangium and tallies. Since the project main purpose is for the deserving people to go to college, then it becomes a priority to harvest at the earliest possible time. Harvesting from second thinning will generate income for the pupils.

Pruned leaves will be scattered over the planted to aggie crops to serve as mulch. The twigs piled evenly along tree and aggie rows to reinforce the contour barrier.

Certification

All trees to be fertilized with 20 gms. of 14-14-14, two weeks after planting and three months after first year one. Repeat the process if year two at triple dosage (60 gms.).

Fertilizer to be applied in band (half micron), one inch deep and one inch wide above the mulching for optimum utilization of fertilizer. Cover the fertilizer with soil to avoid violation of being washed out by rain.

Apply fertilizer at the start of the rainy season and three months after.

Mulching

This is done by placing cut grasses over the cultivated areas around the seedlings (50 cm. diameter) to reduce evaporation and lower soil temperature. The mulching materials also serves as fertilizer upon decomposition. Mulching is critical during summer.

Intercropping

For an arable land, spacing could be wider (x 4) with four meter wide oriented East, west to intercept more sunlight for the crops.

With this set up, intercropping is possible to five years or more, in a way shortening the gestation period of the plantation as the crop could earn from aggie crops while waiting for the trees to mature in 10 years. Intercropping could be done by either first second partly or anybody with all proceeds in intercropped going to the teller since intercropping also favors tree growth. Experience during the first two years counted with trees under ringweeding because cropped is always free from grass and the cultivated.

Intercropping will also serve as a model to go to parents/landowners that raising corn or rice farm is possible up to five years.

Cultural Treatment

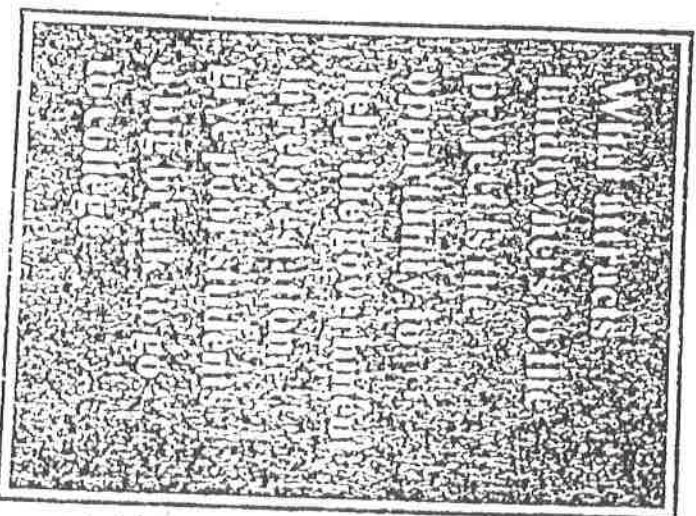
During its done at year one by cutting old branches to hasten apical dominance improve wood quality. The nutrient that were would have been consumed by the old branch will now be utilized by the young branches.

The rule of thumb on pruning is not to remove more than 50 percent of the live crown. Initially the lower half portion of the tree is pruned. On the other hand, thinning is done

by cutting suppressed and cawked trees in between nutrient and sunlight competition. At the initial spacing of 3 x 4 m. for that growing species, thinning may be done in four years or a year after the "close canopy stage" when competition for light become more intense. Generally thinning is done at 50 percent level intensify during the first thinning and another 50 percent on the second thinning at year eight with final crop target of only 200-250 trees/ha.

For the TTF, progressive thinning will be done as need arises, as intense light competition become apparent, or better yet as availability of market, especially from the second thinning when substantial volume will be harvested.

For optimum growth, wood quality, and early investment return at the earliest possible time, appropriate silvicultural treatment will be conducted in the plantation. Pruning could be done at six months or one year, provided



that it should not exceed 50 percent of the live crown, otherwise, photosynthesis process is adversely affected. So pruning from the lower branches, as old leaves in the lower branches has lesser use for the trees.

At spacing of 3 x 4 or 3M trees, start thinning of 30-40 percent at year three to four or after one to two years of canopy closure stage, then repeat thinning at year six to seven of 40 percent level, with target of 200 to 250 trees/ha, as final crop target year 10 or 12 for seven timber such as Gmelina, mangium and acacia.

Budget

The project does not really need budget as some P1A could still be used for the preparation, which could even be

some thousands/pieces. But for start of DENR could subsidize the cost to encourage more participants, later on succeeding TTF developer may be required to reimburse) si

For the initial site preparation we could allot at least P6,000/ha. and P2,000/ha. for inputs (four bags fertilizer) for three years total of P8,000/ha. Expenses to be reimbursed by the developer upon harvest.

Should there be more takers, we could eventually require the developer to reinvest DENR the cost of seedling at P2,000 each P2,000/ha., including seedling for replanting. Plus cost of site preparation and inputs, the budget is P10,000/ha. For Siquijor, TTF target this year is 20 or P200,000.00.

Replicability

The project has a big potential to be replicated in other provinces because of its success appeal to both landowners and PTA/students

The farmer expect big income from farming, opportunity to help the government in the reforestation effort and give poor students a break to go college, while the land needs planting site for their "Pocket Farm Program" while expecting share from the plantations.

Exactly six months after the first PTA and Teachers Association (PTA) meeting on the proposed Trees For Tution Fund (TTF) project at Launa Elementary School, Jan. 10, Siquijor attended by the landowner of the proper TTF site, and DENR personnel last June 1993.

Two additional TTF contract with an aggregate area of three ha. has been consummated, all of which volunteered by landowners themselves, after hearing about the TTF in the province and probably in the whole country.

What attracts landowners to the project is the opportunity to help the government in reforestation and to give poor students a big break to go to college and at the same time expect substantial income on the side, as land farming is now becoming a lucrative investment.

Another plus of the project is that participating students will appreciate early in life the values of hardwork, of caring trees for the economic and ecological benefits. These values will later on be passed on to their offspring, and so on, thus, eventually creating an industrious and environmentally friendly society the next two generations.

What is essential is the active participation of the PTGS to institutionalized the project. And of course, the support of other line agencies, LGU, NCJ and the church in convincing landowners to go TTF.

The Mangroves of Cogtong Bay

Bohol has a rich mangrove biodiversity in Cogtong Bay. A survey of 600 ha (out of its 1,400 ha) revealed 33 true mangrove species, including rare species that have not been previously identified in the country's list of mangroves done by early botanists.

Cogtong Bay is east of Bohol, two hours ride from Tagbilaran City. It spans the municipalities of Anda, Candijay and Mabini.

A big portion of the mangrove stand from Mabini to Anda is protected area by virtue of Presidential Proclamation 1251. Three of Cogtong Bay's five islets are considered wilderness areas under Presidential Proclamation 2151.

All the Cogtong Bay islets are covered with washout mangrove dominated by **bakauan babae** (*R. mucronata*), **bakauan lalaki**, (*R. apiculata*), **pagatpat** (*S. alba*) and **bungalon** (*Avicennia marina*).

The bay is supplied with fresh water by Sagunay, Matulid and Cabidian rivers that have an average width of 30 m.

The mangroves of Cogtong Bay are the biggest in Bohol. They have served as sites of several projects of the Department of Environment and Natural Resources (DENR), making the coastal barangays quite aware of mangroves' ecological value.

The Central Visayas State College of Agriculture, Technology and Fisheries (CVS-CATF), a strategic institution for mangrove conservation and development, is located in the area.

Mangrove Biodiversity

The survey of Cogtong Bay's mangroves in May 1998 mostly covered barangays Buyuan and Panadaran of Candijay (400 ha) and Tangkigan and Poblacion II of Mabini (200 ha).

The 33 species identified and their common names are listed in Table 1.

With only four of the eight barangays under the three municipalities were covered, it is very possible that there are more yet to be discovered mangrove species in the Cogtong Bay area.

Of the 33 recorded species, **api-api**, **bungalon**, **pagatpat**, **bakauan lalaki**, **pagatpat baye**, **tabigi**, **tabyao** and **nipa** were the most dominant.

The four Bruguierras, which are now seldom found together in a 500-ha area, were also sighted. A pure stand of **pagatpat baye**, probably the only one in the Visayas, was also found.

Only Cogtong Bay probably has all the three *Sonneratias*, with *S. ovata* in a pure stand in Panadaran, Candijay. This spe-

found only in one site in Siquijor and in two sites in Bohol.

Another rare species found is the **tabyao** or **cajugao**, the only *Xylocarpus* with pneumatophores that start to emerge after 10 years. It is very close to **tabigi**, except for its smaller, dark green leaves with pointed apex, very much smaller fruits and fissured bark.

Table 1. Cogtong Bay mangrove species and their common names.

Major Mangrove Species

Avicennia marina - bungalon
A. alba Blume - bungalon-puti
A. officinalis L. - api-api
A. lanata Ridly - piapi

Lumnitzera littorea [Jack.] Voight - kulasi
L. racemosa Willd. - tabao

Nypa fruticans - nipa

Rhizophora apiculata Blume - bakauan lalaki
R. mucronata Lam. - bakauan babae
R. stylosa Griff. - bakauan bato or bangkaw
R. x lamarkii Mont. - bakauan hybrid *

Bruguiera gymnorhiza [L.] Lamk. - busain
B. sexangula [Lour.] - pototan
B. cylindrica [L.] Blume - pototan lalaki
B. parviflora [Romb.] W. & A. ex Griff. - langarai

Ceriops tagal [Perr.] C. B. Rob - tangal
C. decandra [Griff.] Ding Hou - malatangal

Sonneratia alba J. Smith. - pagatpat
S. caseolaris (L.) Engler - pedada
S. ovata Backer 1929 - pagatpat baye

Minor Species

Dolichandrone spathulata - tui

Campostemon philippinense [Vid.] Becc. - gapas-gapas

Excoecaria agallocha L. - buta-buta

Pemphis acidula J. R. & G. Forst. - bantigi

Xylocarpus granatum Koen - tabigi
X. muluccensis (formerly *X. mekongensis*) - tabyao/cajugao

Aegiceras corniculatum [L.] Bico - saging-saging
A. floridum Roem & Schult. - tinduk-tindukan

Osbornia octodonta F. Muell. - taualis

Acrosticum aureum L. - lagolo

A. speciosum Willdenow - lagolo

Scyphiphora hydrophyllacea Gaertn. f. - nilad

Acanthus ebracteatus Vahl - tigbau

Mangrove Associates

Intsia bijuga [Collebr.] O. Ktze. - ipil

Heritiera littoralis Dryand. ex Alt. - dungon-late

Planted **bakauan babae** that produces yellow propagules was also found in one of the fishpond dikes. So was a 13-year-old, healthy **bakauan bato** plantation in front of Barangay Market of Cogtong, established by the Integrated Social Forestry Program of DENR.

Threats to Biodiversity

The rich biodiversity of Cogtong Bay's mangroves are threatened by woodcutters and fishpond developers. Unless these are controlled, Bohol can lose its precious mangrove stands.

Bancas loaded with **tabigi** poles are commonly seen in the area. Fishpond developers are back in harness due to the increasing price of bangus and shrimps.

It is fortunate that some barangays that are aware of BEAR-DENR laws and regulations vigorously protest the re-development of abandoned areas covered by Fishpond Lease Agreements (FLAs), some of which have been foreclosed by banks.

What Can Be Done?

Several things must be immediately done to help conserve the biodiversity of Bohol's mangroves before it is too late.

The province's capability in mangrove management should be enhanced.

DENR and the local government units (LGUs) should completely stop illegal mangrove cutting and illegal fishpond operation. Concerned agencies should expedite the reversion of all abandoned/undeveloped FLAs.

The government should compel banks to turn over foreclosed FLAs to DENR so that these can be put under Community-Based Forest Management.

Mangrovetums, mangrove plantations consisting of several species cultivated for educational, research, seed production and ecotourism purposes, should be established by LGUs. The plantations can be designed to allow passage of bancas and make them added attractions for ecotourism.

Reference:

Ding Hou, 1996. Flora Malaysiana.
Visayas: mangrove plant communities

The author is Provincial Environmental and Natural Resource

Bakauan backyard for wind and tidal break

by CALIXTO E. YAO
Department of Environment and Natural Resources

Region VII

Dusty winds and strong waves are the perils and discomfort of seashore dwellers, especially those who live in ramshackle huts. Through the years, some of these dwellers were able to protect themselves against such natural occurrences by establishing pockets of bakauan plantations in their backyards to lessen the impact of strong winds and mini surf waves that may destroy their fragile makeshifts.

The above scenario — rows of houses along the shoreline with bakgau (*Rhizophora stylosa*) stands (from 500 to 2,000m²) in the backyard — is what makes barangay Okiot of Dewey Island, Bais City different from other seashore dwellers (Yao 1985).

Okiot has a wide strip of tidal flat during low tide. The barrio is exposed to strong winds and pounding waves, especially during the monsoon season. Although there are some patches of bungalon (*Avicennia marina*) stands, these are not dense enough to lessen the impact of the fury of the winds and the waves.

ing bakgau in their backyard. Thus, the bakauan backyards which provide forest products/protection have become a landmark in Okiot.

The individual backyard could be expanded into a forest community, especially in a place where there is a wide tract of low tide area, say, from 300 to 500 m from the shoreline and a stretch of 1 to 2 km or more. The community forest of 20 to 30 ha, aside from the bakauan backyard, could provide protection and products to the community. These could be done through the bayanihan system, where members of the community could work together for a common goal. Moreover, the large tract of mangrove forests could serve as a niche to some important marine life such as shrimps and siganids, thus providing additional catch to fishermen. A study in Indonesia showed that the amount of commercial shrimp catch is highly correlated to the size of the mangroves (Matsuboro et al. 1977).

Another way of establishing a community forest is parceling out the area to families who will do the planting. This practice had already worked in Banaon, Jucate, Bohol (Yao 1985). The islanders have already planted bakgau in about a hundred hectares of wide flat sand.

Planting tips

For a successful establishment of bakauan backyard, the following tips may be of help:

Species. For sandy and rocky areas, use bakgau. It grows fairly well compared to other *Rhizophora* species. Use a crowbar when planting in rocky

areas. For muddy areas, use either bakauan babae or lalaki. About three fourths of the length of the hypocotyl should be buried to ensure stability.

Spacing. The general spacing used is from 20 to 30 cm, especially in areas where the sea current is rather strong. In relatively calm seas, the spacing could be modified up to 50 cm with proper alignment to facilitate thinning later.

Water level. *Rhizophora* species could survive even in areas where the sea bottoms are not totally exposed during high tide, provided that at least one third of the hypocotyl is above the water level during low tide. This means that bakauan babae (*Rhizophora mucronata*) which has an average hypocotyl of 60 cm could be planted in areas with 20 cm water level at low tide. Whereas bakauan lalaki (*Rhizophora apiculata*) and bakgau which have shorter hypocotyl (20-30 cm) could only be planted in areas with lower water level (5 cm).

Protection. Barnacle incrustation is one of the major causes of high mortality of *Rhizophora* species, especially in deltaic areas where salinity is lower. In barnacle-infested areas, mortality could be as high as 90%. In the absence of chemical treatment, barnacle could be scraped manually from the hypocotyl every now and then until the plants develop enough leaves for photosynthesis. Seedlings or potted *Rhizophora* could also be used for higher resistance to barnacles.

Seedlings and plants could also be a serious threat to young seedlings. Heavy disposition of these weeds could engulf young plants to death. Thus, it is necessary to check young plantations more often.

Species diversity. Tidal wind break need not be limited to the bakauan group where it is possible, or species such as *paga* (*Sonneratia casuarina*) for fire and timber; *api-api* (*Avicennia marina*), *tabigi* (*Xylocarpus* spp.) for luxury lumber construction material, and *ta* (*Ceriops tagal*) for tanbark retardant for tuba making.

"bahalina" industry could be planted. The Brugu group: *pototan* (*B. sexangulata*), *potolalaki* (*B. gymnoriza*), *potolalaki* (*B. cylindrica*), and *larrai* (*B. parviflora*) could be tried, especially in mud sites. For higher survival, proposed windbreak area could be fringed with 5 to 10 m w of bakauan species at a close spacing (20 x 30 cm).

Oneday, a resident toyed with the idea of planting bakgau, the dominant *Rhizophora* species in the area, right at the back of his house. Bangkau was planted at a very close spacing of 20 to 30 cm. A year after, his backyard had a matted bangkau. Five years later, the stand had an average height of 2.5 m, providing his home ample protection from winds and waves. After four more years, the bakauan backyard also provided the residents some construction materials and poles for fish corrals. With the benefits from bangkau stand, some residents have also started plant-

Bakauan backyards have a great impact on the community, especially now that our forest resources are fast dwindling. If half of the thousands of families living along the shoreline with plantable areas plant bakauan in their backyard, it would to be produced wood have a significant impact on fuelwood supply.

Aside from their protective and productive value, mangrove stands also have a proven beneficial effect on marine life and on aesthetic value. Thus, the more bakauan backyards we have, the more ideal habitat for marine life, and the more productive our shorelines.

Literature cited

Matsuboro, Permuto and Nurul Hamin. 1977. Relationship between tidal forest and commercial shrimp production in Indonesia. (Continued on page 8)

The 400-ha bakauan plantation of Banacon Island of Getafe in the province of Bohol has placed the

Philippines on the world map since 1950s as far as community-based mangrove rehabilitation is concerned. Another islet, 14 km east of Banacon, is Calituban, Talibon which has 380 ha of bakauan plantation established under the contract reforestation program of the Department of Environment and Natural Resources (DENR) in 1990. Within Talibon is the Calituban Reef, the only double-barrier reef in the country composed of Calituban Reef as the inner barrier and the Caubyan Reef as the outer barrier.

Calituban Reef is bare during low tide, and one could walk the 15-km stretch from Banacon Island to Calituban Island. The southern edge of the reef facing the mainland has an existing natural growth of pagatpat (*Sonneratia alba*) and bungalon (*Avecinia marina*), a good indication that the area could be planted with other mangrove species. The presence of a big pagatpat tree midway between the two islets also indicates that perhaps the area was once thickly covered with mangroves.

The reef contains white sandbars (exposed at low tide) which are ideal picnic areas. The mangrove strip will provide shade to visitors/picnickers and roost for birds that feed on seagrass areas (Calangaman). Later, when the mangroves are fully established, a "mangrove trek" could be promoted where visitors could do fishing/gleaning and have their catch cooked in some of the kiosks/huts that would be

Mangrove strip along Calituban Reef: A would-be ecological destination

Calixto E. Yao

constructed in strategic areas along the plantation.

The proposal

The proposed mangrove strip was conceptualized in 1996 during an inspection of the long strip of bakauan bato (*Rhizophora stylosa*) plantation in Calituban Island. Since the Calituban Reef has a wide sandflat (800 m) that is exposed during low tide where one could hike from Calituban to Banacon, it is proposed that the two barangays be connected with a 50-m strip of mangrove plantation of different species and varied planting designs.

Activities

The would-be mangrove strip will entail the following activities:

- ☐ *Site evaluation.* To determine the potential areas for mangrove planting and the most appropriate species, a site evaluation will be conducted considering the following factors: (1) substrates, (2) inundation/tidal waves, (3) existing and previous vegetation (stumps, if available) and seagrasses, (4) prevailing sea current, (5) gleaning areas, (6) banca/pumpboat routes, (7) marine life, (8) fishing activities and (9) bird species.

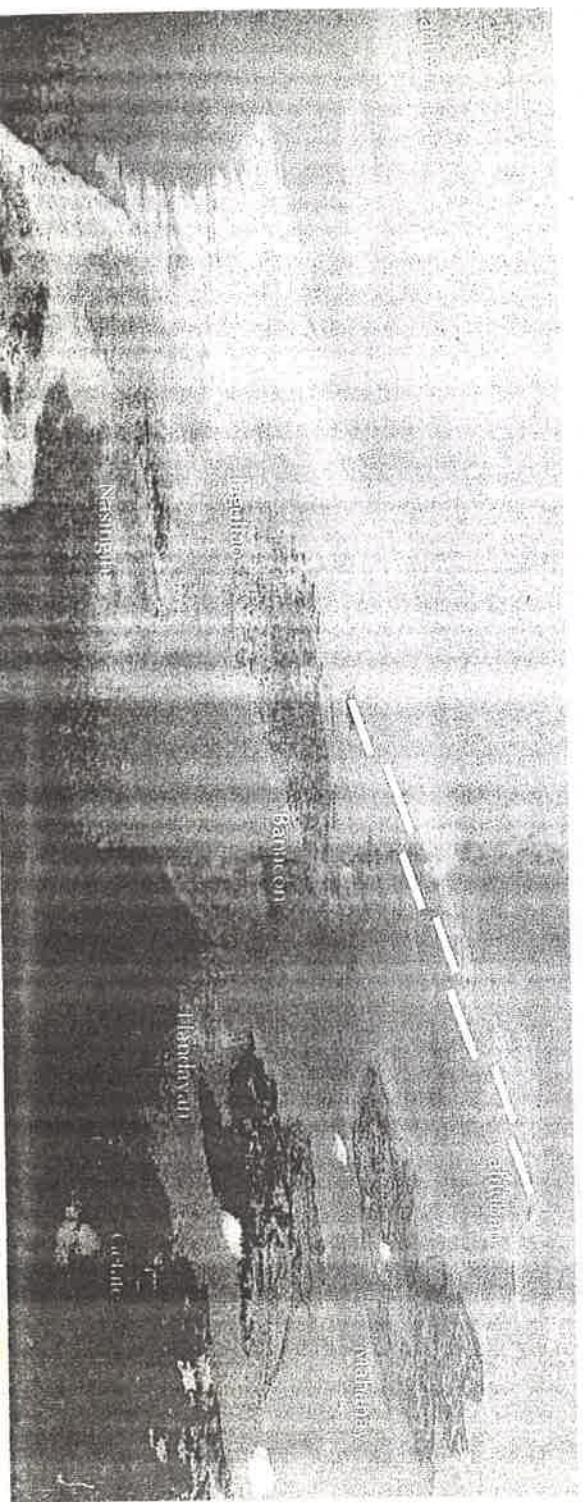
- ☐ *Plantation establishment.* Based on data obtained from the evaluation, planting may be done by direct sowing of propagules, or by potted seedlings, especially of pagatpat and bungalon. Planting may be done by blocks or clusters, following the established strip. In long continuous strip, gaps of 30 m will be provided for pumpboat/banca passages. The maximum length of strip is 100 m to minimize obstruction of water flow. To ensure high survival rate, planting will be done at closer spacing, say 30-50 cm. The proposed strip is about 15 ha and would cost from P20,000 to P30,000/ha, depending on the planting materials.

Funding

The project may be funded under the special or regular budget of the DENR, or by the municipalities of Getafe and Talibon, both of which have applied for Community-Based Resource Management Project (CBRMP), a World Bank-assisted project. Other donor countries/projects involved in coastal resource management may also be tapped.

Expected amenities

- ☐ *Mangrove trek.* Once the mangrove strip is fully established (in 5 years), a mangrove trek from Banacon to Calituban and vice versa will be



older) and two levels of tilling cycles (every year and every two years).

Results of the study showed that the most appropriate harvesting intensity for kauayan-tinik is the 100% cutting of culms (three-year-old and older) with a felling cycle of one year. It yielded an average of 4.33 poles per clump per year at age four, and an average of 8.91 poles per clump per year at age 10.

8	7.58	8.41
9	7.33	8.91
10	8.91	15.33

Results of the study would provide valuable input for sustained and improved bamboo-pole production and plantation development. It would also provide policy direction with regard to the sustainable management and harvesting of these two important

plantation of important bamboo species.
DENR/FAO/UNDP Bamboo Research
and Development Project. PH/85/008.
Los Baños, Laguna.

The first and second authors are Science Research Specialist and the third is Supervising Science Research Specialist of the Technology Development Division, ERDB.

Mangrove strip...from page 5

promoted with Getafe and Tailbon as entry points. A guided tour will be provided by the organized community, trained in ecotourism management. Included in the package are pumpboat/banca services, fishing/sea-shell gathering, bird watching and cookout. Visitors may also plant mangroves in designated ceremonial planting sites.

□ *Picnic.* For beach lovers, they can have a dip in one of the sandbars with the kiosks and mangrove strip nearby for shade/shelter.

□ *Bird watching.* A place in Banacon, called Calanmanan where larvae

Mangrove strip...from page 9

The would-be eco-destination is along the Danahon Bank, located north of Bohol. The bank consists of two main reefs: Caubyan Reef and the Calituban Reef. The Caubyan Reef, the outer barrier, stretches 80 nm (130 km), an average width of 1.5 nm (2.5 km). The reef is exposed during low tide and has two islets – Caubyan Gamay and Caubyan Dako (unpopulated). The inner barrier, on the other hand, is the Calituban Reef where the Banacon and the Calituban islets are located. In between the two barriers is the outer lagoon with an average depth of 46 km (Pinoch, 1977). Both reefs are covered with 1.5 m of water, with large areas exposed during low tide (Grobe et al., 1988).

Other points of interest

Aside from the mangrove strip, there are other places of interest within the Danahon Bank:

□ Seashore Sanctuary – situated in Handuyan Island, Getafe, Bohol. The seashore project is run by the community assisted by the Haribon

seagrass beds thrive, is frequented by migratory birds. Probably these are the same flocks that are visiting the Olango Island in Cebu.

□ *Kayaking.* The Camotes Island and the Caubyan Reef protect the site from the strong, northerly winds. Thus, the area, with its relatively calm waters, is ideal for kayaking, a new thriving sport in Cebu City. A kayak expedition along Olango Island-Calituban Reef can be promoted. The mangrove strip will provide a good backdrop and protection for the kayak enthusiasts.

Comanagement:

Potential funding agencies of the project may tap the local communities

Foundation, an environmental organization.

□ Banacon Mangrove Plantation – an existing ecological destination for local and foreign visitors because of its highly successful community-based mangrove rehabilitation.

□ Seaweed Farm – one of the biggest seaweed farms in the country, which will supply would-be markets with carrageenan, is located east end of the Calituban Reef.

Potential environmental impact and mitigation

The would-be plantation is expected to cause some environmental changes but corresponding measures are being considered seriously to minimize any adverse effects:

□ Accretion/Sedimentation – with the very close spacing, sedimentation may be speeded up. The process may be retarded by thinning, once the plantation is fully established.

□ Obstruction of sea current/water flow – the gaps for banca passages and

to manage and protect the plantation. This is to ensure sustainability and provide the residents with livelihood opportunities. Since the reef is under different municipalities/barangays, they could have an individual or comanagement over the area. The management of Banacon, a protected area, will have to be approved by PAMB.

The project site

Initial findings show that the reef contains a wide area of white sand that is ideal for picnicking. There is also a place which residents of Banacon call Calanganman because large flocks of birds would feed on the seagrasses at low tide.

thinning will minimize obstruction on sea current, especially in areas where planting is by clusters.

□ Marine biodiversity – seashell species will definitely change as sandy substrates turn into slime, as in Banacon, but since plantation is only 10 ha net, the change may be negligible compared to the benefits from increased detritus production and ecotourism value.

References

- Grobe, H., H. Willkom and G. Wefer, 1988. Intend structure and origin of the double reef of North Bohol and the Olango Reef Flat.
Pinoch, M. 1977. Physiology, morphology and ecology of the double-barrier reef of North Bohol.

The author is Provincial Environmental and Natural Resources Officer of PENRO-Region VII.

I like trees because they seem more resigned to the way they have to live than other things do.

Willia Cather 1873-1947

bags are tied to the selected bamboo culms. For two weeks, roots which have formed will be visible. Then the culms are then cut into one-node lengths and the marcot bags removed. Then these are planted and cared for in the nursery as in the simple cutting method.

What other opportunities do bamboos offer?

Bamboos can be commercialized in nurseries. There is a high demand for bamboo poles, the planting materials can easily be propagated, but very few still engages in propagating bamboos in nurseries to sustain the ever-growing demand. A one-hectare bamboo nursery can produce 2,000 planting materials per year and this can plant 10 hectares. The cost of producing a one-year old bamboo seedling in the nursery is P38.50.

Establishing a bamboo plantation is also very bankable. The cost of establishing a bamboo plantation for the first five years is P80.00 per bamboo plant. The first harvest comes in the sixth year. Then, the annual income thereafter is P48.00 per plant. For the harvesting, the cutter fells the poles and strips the branches and the hauler carries the poles on his shoulders out of the plantation to the pick-up point. These are the only costs involved. Poles are sold at prices ranging from P50.00 at farmgate, pick-up to P150.00, and delivered at Metro Manila.

The Kawayan Farm is a 20-hectare former upland-coagonal area planted to kawayan (unit by Engr. Alfonso in 1983 through 1985, numbering some 3,000 seedlings. It is now a bamboo forest, having been commercially harvested since 1989 and every year thereafter. At its center is a bamboo nursery which produces 7,000 one-year old seedlings annually. These are disposed of, with certain limitations, to the general public "at cost" which is P50.00 each today.

Engr. Alfonso states that there is still a need to establish bamboo nurseries and bamboo plantation to meet the growing demands, mostly coming from private individuals and agencies. Looking positively at the success of reforesting the upland-coagonal areas with bamboo, he encourages every individual to plant bamboo, not mainly for economic upliftment but mostly for environmental rehabilitation.

Aside from establishing a bamboo nursery and plantation business, bamboo is proven profitable for the many products that can be crafted out of it. The bamboo furniture business continues to expand, together with the various interior decors and handicrafts. The ingenuity of any individual to create something of high quality from bamboo promotes the Philippine economy. This also uplifts the morale of any Filipino who is also well-known for his originality and creativity. □

Mangrovetum for seed prod'n and botanical attraction

By C.E. YAO

One of the objectives of the recent thrust of DENR on Coastal Environment Program (CEP) is mangrove rehabilitation and biodiversity for timber and detritus (decaying mangrove leaves that serves as food for marine life) production and for protection of our coastal infrastructure from strong wind and waves. The mangrove also reduces sedimentation that could caused damage to our sea corals/sea grasses, two components of the coastal environment that are important to marine life.

Mangrove reforestation is an old agenda of DENR and other agencies but so far the species used has been limited to the three *Rhizophoras* due to lack of technology or other species. Said problems however could easily be solved by establishing a mangrovetum, planting several species in a selected sites free from strong winds and waves such as coves/covelets, riverine and abandoned fishponds. Mangrovetum is a plantation consisting of several mangrove species on specific area, generally use for experimental and educational purposes. In this proposal, mangrovetum is not only intended for research study but more so for seed production, specially for the following genus such as the *Cerrops*, *Brugieras* and *Xylocarpus* and the rare species of *Sonneratia* (pedada). Mangrovetum will also ensure biodiversity.

The Establishment

For higher survival and fast growth, mangrovetum should be established following the zonation pattern of the species, that is species identified to thrive along the seaward side of the mangrove area such as pagatpat, bungalow, bakawan bato, while species known to thrive at the landward side such as the *Pototan* and *Tabigi* should be planted at the landward side.

However, if such area is not available, a one hectare lot will do just for a limited number of species 10-20 per hectare. The one hectare lot could be divided into four quadrant to accommodate two to four species per quadrant per genus or by families for easy comparison/identification. This kind of arrangement may not necessarily follow the zonation pattern as recommended above but it has an interest advantage because one can easily compare/differentiate each species under the same genus. For example in one quadrant, the three

Rhizophoras, *Bakan babae* (*R. Macronata*) *Bakan lakale* (*R. Apiculata*) and *Bangkan* or *Bakawan bato* (*R. Stylosa*) could be planted in separate plot with the quadrant.

On the otherhand, the four *Brugieras* and two *Cerrops* could be planted in separate quadrants. (Each quadrant with three to seven m. gaps for "banca" passage so that visitors could identify/examine the species while boating). Each species/block will be properly tagged (local, common and scientific names and their respective uses) for added information.

Later on, a handouts describing the different characteristics of the different species will be given to visitors for easy identification/differentiations.

Spacing

Since the purpose of the mangrovetum is seed production, initial spacing for smaller trees is 1 x 1 m. to be pruned/thinned as need arises for better form and more seeds. For *Xylocarpus* and *Heritiera*, spacing is from 2 x 2 m. to 2 x 3 m.

If possible, planting should be done at the same time. But since species have different fruiting season, the first available species may be potted until the rest of the species are available. Propagules not available in your locality could be collected from other provinces/region where same are available.

The reason for planting the species together is to avoid overtopping as much as possible. Another way of avoiding over-tapping is to plant each species at a wider gap from five to 10 meters.

Priority Species

For a starter, mangrovetum could be established from a half hectare site accommodating the genus *Rhizophoras* and *Cerrops* or *Cerrop* and *Brugieras*. For a whole hectare all the *Rhizophoraceae* family could be accommodated. In areas seldom reach by tidal inundation, the following species could be planted:

1. *Xylocarpus* (*tabigi* and *piagao*)
2. *Dungon* late
3. *Lumnitzera* (*unbao* and *kulasi*)
4. the *Brugieras* (*potatin*, *busanin*) *pototai lakale* and *langarai*.

Since the objectives of mangrovetum is to

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