



MEMORANDUM FROM THE SECRETARY

TO : The Regional Executive Directors
Region 1-12, CARAGA and NCR

The Directors
Biodiversity Management Bureau
Ecosystems Research and Development Bureau
Forest Management Bureau

SUBJECT : **SUPPLEMENTAL GUIDELINES ON ENRICHMENT PLANTING OF MANGROVES AND RELATED ACTIVITIES FOR BIODIVERSITY CONSERVATION AND COASTAL RESILIENCY**

DATE : JAN 16 2024

Pursuant to our Department's mandate to protect our natural resources, providing herewith are the supplemental guidelines on enrichment planting of mangroves and related activities for biodiversity conservation and coastal resiliency. This is a supplement to ERDB-BMB Technical Bulletin No. 2017-01, or "Guidelines on enrichment planting of mangroves and related activities for biodiversity conservation and coastal resiliency", based on the recommendations from Dr. Jurgenne Primavera which are as follows:

Recommendations of Dr. Primavera	Enhanced Guidelines on Enrichment Planting
Prioritizing reversion of Abandoned Ponds (over seafront/seagrass planting)	IV. Areas suitable for enrichment planting 3. Abandoned, Unutilized and Underdeveloped (AUU) Fishponds that have been officially turned over by BFAR to DENR
Stop planting on Seagrass Beds Plant only in the middle to upper intertidal zone. Do not plant on intertidal mudflats	V. Areas prohibited from enrichment planting c) Seagrass beds e) Mudflats/tidal flats f) Lower Subtidal Zones
Minimize seafront planting if necessary. Stop planting <i>Rhizophora spp./bakhaw</i> . Disallow procurement of bakhaw propagules in Mangrove projects.	V. Areas prohibited from enrichment planting Planting of <i>Rhizophora</i> species in seaward zones shall be strictly prohibited.

Plant <i>Avicennia marina</i> and <i>Sonneratia alba</i>	VI. Species Selection Table 1. Suggested mangrove species per zonation
Direct all Regional Executive Directors to have <i>A. marina</i> and <i>S. alba</i> nursery.	VII. Nursery Establishment and Management 3. Collection of Planting Materials -DENR Offices within or near coastal areas shall include mangrove species in their seedling production except <i>Rhizophora spp.</i>
Capacitate nursery staff of all coastal Regional Offices on <i>A. marina</i> and <i>S. Alba</i> germination rearing via ERDB experts or ZSL training courses.	X. Capacity Building and Stakeholder Collaboration The ERDB experts on mangroves shall conduct field-based training on mangrove conservation, management and rehabilitation and capacitate nursery staff of all Regional and Field Offices (CENROs and PENROs). The Field Offices may cascade the training to the implementation partners such as People's Organizations on mangrove nursery establishment and plantation management. Partnerships with Higher Education Institutions (HEIs), Civil Society Organizations (CSOs) and the private sector is highly encouraged.

Please see the attached supplemental guidelines on enrichment planting in mangrove areas.

For information, compliance and widest dissemination.

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ENHANCED GUIDELINES ON ENRICHMENT PLANTING OF MANGROVES AND RELATED ACTIVITIES FOR BIODIVERSITY CONSERVATION AND COASTAL RESILIENCY

I. Rationale

Mangrove forests are important components of the coastal ecosystem that perform a significant role in providing coastal defense and buffer against strong waves and storm surges brought about by typhoons and other similar climate-related phenomena. They also help prevent soil erosion during heavy rains, help minimize water pollution and serve as water catchment areas that reduce flooding. Mangroves also serve as habitat and nursery ground for marine fishes, crustaceans and other fauna thus, sustaining and improving fisheries productivity.

Mangroves, in particular, provide the necessary conditions for nutrient recycling storage of vast amounts of carbon. Mangroves, sea grasses and tidal salt marshes are estimated to sequester carbon 10-50 times faster than terrestrial systems (McLeod 2011 and Da Silva 2011, as cited by Benson 2017). In addition, mangroves are among the most carbon-rich ecosystems, reportedly containing an average of 937C ha (Alongi 2012).

In the Philippines, human activities have altered much of the mangroves and beach forests over the past century. There are numerous factors affecting the growth, distribution and development of mangroves such as: tidal elevation, sea level influence, hydrology, salinity, sedimentation rate, soil composition, rainfall and freshwater source (Jimenez and Lugo 1985 and Primavera et al. 2012). Moreover, environmental stressors such as climate (e.g. typhoons) are some of the risks which can adversely affect its growth and development. This contributes to high mortality rates in mangrove plantations and long periods of succession before attaining the full canopy or climax stage.

In all circumstances of mangrove forest degradation characterized by patchy or sparse vegetation, enrichment planting ensures that the density and diversity of mangrove forest ecosystems can be restored at an accelerated rate including the other ecosystem services they provide. These enhanced guidelines will serve as guide for the enrichment planting in mangrove ecosystems.

II. Objectives

This enhanced guidelines aims to:

General Objective: Promote biodiversity conservation and coastal resiliency.

Specific Objectives:

- a) Provide proper guidance in the conduct of enrichment planting in mangrove areas;
- b) Ensure science-based planting practices in mangrove areas; and
- c) Promote transparency in reporting enrichment planting in mangrove areas.

III. Scope and Coverage

These enhanced guidelines shall cover natural and plantation mangrove forest areas.

IV. Areas Suitable for Enrichment Planting

1. Natural mangrove areas with sparse vegetation characterized by presence of 625-1499 trees/hectare (FAO 1996) beyond which the mangrove area is already considered dense such as logged-over areas, areas damaged by typhoons and other climate related phenomenon, and areas with sparse vegetation near mouths of rivers.

Refer to Ecosystems Research and Development Bureau (ERDB) - Technical Bulletin No. 2 (2015)¹ for guidance on calculating the number of trees per hectare.

2. Mangrove plantations that are:
 - a) Heavily damaged due to natural causes like typhoons and other climate-related phenomenon;
 - b) Damaged by pests and diseases; and
 - c) Monoculture plantations with sparse vegetation.
3. Abandoned, Unutilized and Underdeveloped (AUU) Fishponds that have been officially turned over by BFAR to the DENR.

V. Areas Prohibited from Enrichment Planting

No enrichment planting shall be conducted in the following areas:

- a) Seagrass beds
- b) Areas damaged by algal bloom
- c) Areas with high garbage deposition
- d) Areas with unstable and unsuitable substrates (e.g. sand shifting areas, rocky-coralline substrates)
- e) Mudflats/tidal flats
- f) Lower Subtidal Zones

Planting of *Rhizophora* species in seaward zones shall be strictly prohibited.

VI. Species Selection

Enrichment planting can make use of propagules, wildlings and potted seedlings depending on location and substrate. Below are the suggested mangrove species for enrichment planting.

Table 1. Suggested mangrove species per zonation

ZONATION AND PRESCRIBED HEIGHT	SPECIES
Seaward to Landward (minimum 50 cm to 150 cm height)	<i>Avicennia marina</i> Forssk. Vierh. (Bungalon) <i>Sonneratia alba</i> Sm. (Pagatpat)

¹ Mangrove and Beach Forest Development Project

ZONATION AND PRESCRIBED HEIGHT	SPECIES
Middleward to landward (minimum 30 cm to 60 cm)	<i>Aegiceras corniculatum</i> Lour. Poir. (Saging-saging) <i>Aegiceras floridum</i> Roem. And Schult. (Tinduk-tindukan) <i>Avicennia marina</i> var. <i>rhumpiana</i> Forssk. Vierh (Piapi) <i>Avicennia officinalis</i> L.K.D. Koenig (Api-api) <i>Bruguiera cylindrica</i> (L.) Blume. (Pototan lalaki) <i>Bruguiera gymnorhiza</i> (J.F.Gmel.) Blume (Busain) <i>Bruguiera parviflora</i> Roxb. With. & Arn. Ex. Griff (Langarai) <i>Bruguiera sexangula</i> (L.) Lam (Pototan) <i>Ceriops tagal</i> Perr.C.B.Robb (Tangal-most preferred) <i>Ceriops zippeliana</i> Blume (Malatagal) <i>Heritiera littoralis</i> Aiton (Dungon-late) <i>Lumnitzera racemosa</i> Willd. (Kulasi) <i>Lumnitzera littorea</i> (Jack) Voigt. (Tabao) <i>Osbornia octodonta</i> F. Muell. (Tawalis) <i>Scyphiphora hydrophyllacea</i> Gaertn. (Nilad) <i>Sonneratia ovata</i> Backer <i>Xylocarpus granatum</i> J. Koenig (Tabigi) <i>Xylocarpus moluccensis</i> (Lam.) M. Ruem (Piagau)
Riverine-upstream (minimum 30 cm to 60 cm)	<i>Nypa fruticans</i> Wumb. (Nipa) <i>Sonneratia caseolaris</i> (L.) Engl. (Pedada)

VII. Nursery Establishment and Management

Before conducting enrichment planting, several in-situ small-scale mangrove nurseries shall be established to lessen hauling stress and acclimatize the seedlings to the prevailing microclimatic conditions.

1. Considerations for Site Selection of Mangrove Nurseries

- a) Relatively flat and firm substrate
- b) Close to river or freshwater sources
- c) Good drainage (not water logged)
- d) Within or close to planting site
- e) Protected from wave action
- f) With gaps and opening with mother trees for shade
- g) Flooded during spring tide (high tide)

2. In-Situ Nursery Operation

- a) Site Preparation will involve removal of debris, trimming of branches that may hinder the growth and development of seedlings to be raised.
- b) Fencing using bamboo poles and fish nets to prevent stray animals and debris from destroying the seedlings.

- c) Construction of nursery facilities such as potting shed, seed box, seed beds, pot beds, hardening beds and storage room.
- d) Put plastic lining on seed beds to prevent the primary roots from penetrating in the soil.
- e) Mangrove soil is the best potting medium to be used due to the rich organic matter and nutrients, removing the need for fertilization.

3. Collection of Planting Materials

The right timing in collecting plantable materials is very crucial in nursery activities for mangrove forest. For detailed information on the phenology of the suggested mangrove species for enrichment planting, please refer to the Guidebook.²

- a) Propagules/fruits - being viviparous matured propagules poses ring-like abscission at least 1 cm in length between the fruit and the pericarp. Collect the matured propagules/fruits in the standing mother trees to lessen stress and damage caused by natural factors.
- b) Wildlings - numerous species of mangrove can be propagated using wildlings except for *Rhizophora* spp. Wildlings can be collected under the mother trees, abandoned fishpond, and swash zone. Maximum size of wildlings to be collected is 50 cm in height and it can be conditioned in the nursery at least 3 months before out planting. It can be collected through carefully earth-balled and placed in a potting bag.

DENR Field Offices within or near coastal areas shall include mangrove species in their seedling production except *Rhizophora* spp.

4. Handling and transport

After collection, propagules/wildlings must not be exposed to direct sunlight. Sunburns which appear like brownish to blackish spots on the hypocotyls can cause low viability. Propagules should be placed inside moistened sacks which should be kept cool and open at all times. Propagules must be kept under cover/shade to prevent excessive loss of moisture especially during the dry season.

In transporting, keep them in a horizontal position and protected from heat. The use of boat is the most practical means of transporting mangrove propagules to the nursery site. Otherwise, they may be transported manually.

5. Sowing and germination

Germinate the fine/small seeded mangrove (*Sonneratia* spp.) in the seed boxes before transplanting in the potting bag if the germinant has 2 pairs of leaves. For a small seed of *Avicennia* spp., it can be germinated in the seed bed before transplanting or directly planted in the potting bag.

² Phenology and Identification of Philippine Mangrove Species by Palis, Lat, and Alcantara (1997).

Potted seedlings are those mature propagules/seeds/wildlings sown in potting bags and grown in a nursery. *Avicennia spp.* and *Sonneratia spp.* could be propagated from seeds and wildlings.

Non-viviparous small to medium sized seeds of *Xylocarpus spp.*, *Aegiceras spp.*, *Lumnitzera spp.*, *Excoecaria agallocha*, *Nypa fruticans*, etc. and small/short-sized viviparous propagules of *Ceriops spp.* and *Bruguiera spp.*, should be directly grown/ raised in the 5-7cm size potting bags.

6. Sorting and Grading

Group the seedlings with the same species and homogenous sizes to avoid over top or domination of one seedling to another. Select the viable and healthy seedlings free from pests and diseases to be prepared for out planting.

7. Hardening

The selected plantable seedlings will be gradually exposed to full sunlight to prepare the seedlings to the harsh and adverse climatic conditions in the planting site such as strong wind and intense heat to ensure high survival rate. To withstand these conditions, the mangrove seedlings must be well-hardened for around 2-6 weeks before out-planting.

The prescribed plantable size of hardened potted seedlings is minimum 30 cm to 150 cm height which is measured from the base/root collar.

VIII. Procedures for Enrichment Planting in Natural Mangrove Forest and established Mangrove Plantation

Enrichment planting can be done to diversify the species composition and increase the tree density of natural and established monoculture plantations with sparse vegetation through planting of desirable species (potted seedlings) suitable in the area (Species-Site Matching).

1) Site preparation

Remove debris and undesirable materials before out planting. Use 30 cm bamboo stake slanting along the current to serve as a location marker for planting the seedlings. Dig a hole at least 30 cm in diameter and 30 cm in length to have enough space for root development.

2) Hauling

Use crates in transporting the plantable seedlings in the planting site carefully.

3) Planting

Observe zonation patterns in planting. Place the seedling in the hole and cover with soil up to the root collar only and do not compact the soil. Place the whole bag with seedling in the prepared hole, removing only the bottom portion of the bag to make the soil in the bag intact and so as not to

disturb the root system. The maximum total seedlings to be planted should be 400/hectare.

4) Tying

Tie the seedlings into the bamboo stake using biodegradable tying materials to hasten the root development and help the seedling to stand still against wave and wind action.

A navigational lane should be established to provide free access for small boats to pass through so that newly enhanced mangrove plantation will not be an obstruction to their fishing activities.

IX. Maintenance and Protection

The success and sustainability of any plantation mainly relies on the different activities to be done after planting. Plantation care and maintenance in mangrove forests is needed to ensure that sustainability is at least 3 years. The regular activities that should be conducted are as follows:

- a) .Removal of debris and garbage
- b) Patrolling
- c) Replanting of the dead planted seedlings during low tide of planting Season
- d) Monitoring the stand for the presence of pests and diseases
- e) Monitoring the growth and development of the planted seedlings
- f) Strengthening the Communication, Education and Public Awareness (CEPA) campaign

X. Capacity Building and Stakeholder Collaboration

The ERDB experts on mangroves shall conduct field-based training on mangrove conservation, management and rehabilitation and capacitate nursery staff of all Regional and Field Offices (CENROs and PENROs). The Field Offices may cascade the training to the implementation partners such as People's Organizations on mangrove nursery establishment and plantation management.

Partnerships with Higher Education Institutions (HEIs), Civil Society Organizations (CSOs) and the private sector is highly encouraged.

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