Chapter 1
The importance of mangroves

INTRODUCTION

This chapter provides basic information on mangroves specifically:

- Ecological and economic benefits/functions
- Threats
- Protection and management strategies

In addition, four management alternatives for mangroves are suggested for people's organizations (POs), nongovernment organizations (NGOs), community organizers (COs) and others interested in the rehabilitation and sustainable management of the country's mangrove resources.

What is Mangrove?

Mangrove is a type of forest growing along tidal mudflats and along shallow water coastal areas extending inland along rivers, streams and their tributaries where the water is generally brackish. The mangrove ecosystem is dominated by mangrove trees as the primary producer interacting with associated aquatic fauna, social and physical factors of the coastal environment.

The mangrove flora consists of 47 "true mangroves" and associated species belonging to 26 families (Melana and Gonzales 1996). True mangroves grow in the mangrove environment; associated species may grow on other habitat types such as the beach forest and lowland areas. A useful field guide to some Philippine mangrove species has been published by the Department of Environment and Natural Resources (DENR), Region 7 (Melana and Gonzales 1996).

The mangrove fauna is made up of shore birds, some species of mammals (monkeys, rats, etc.), reptiles, mollusks, crustaceans, polychaetes, fishes and insects.

In 1918, some 450,000 ha of mangroves existed in the Philippines (Brown and Fischer 1918). According to DENR 1995 statistics, conversion to fishponds, prawn farms, salt ponds, reclamation and other forms of industrial development has reduced the mangrove area to 117,700 hectares.

ECOLOGICAL AND ECONOMIC BENEFITS/ FUNCTIONS

Figure 1.1 shows the primary ecological and economic benefits and functions of the mangrove ecosystem and these include the following:

- **Mangroves provide nursery grounds for fish, prawns and crabs, and support fisheries production in coastal waters.** Almost every living thing needs a safe place when it is young, small and fragile. Like human babies,

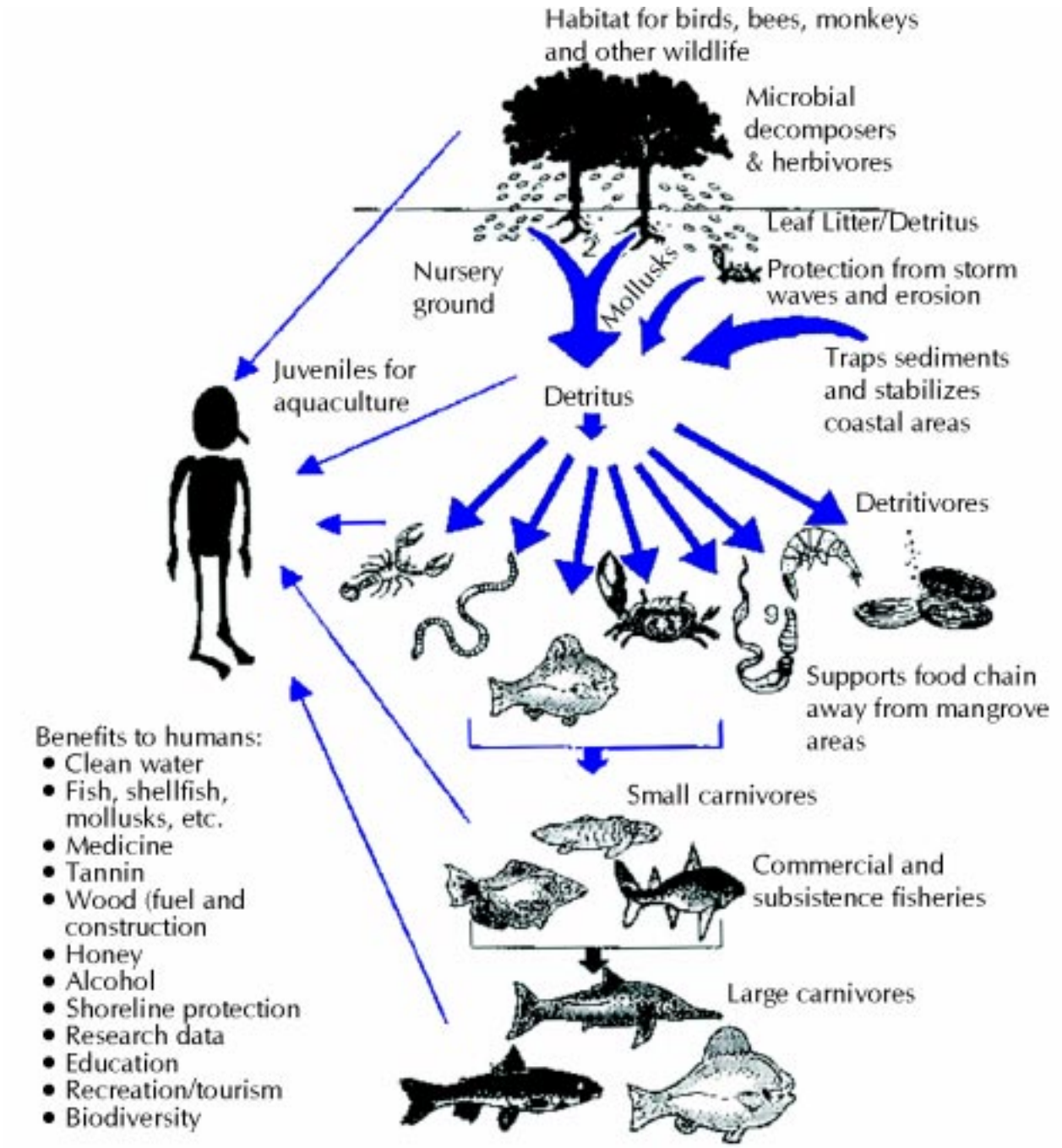


Figure 1.1. Mangroves and their ecological and economic benefits (Berjak et al. 1977).

young fish, shrimp, crabs and other animals in the sea need a safe place to grow, away from many predators. Only those young animals that find refuge survive to grow to full size. Smaller fish or shrimp swimming in open waters may soon be eaten by larger fish. Mangroves are good nurseries because they provide hiding places for young animals. The arched-shaped roots of the *bakauan* mangroves and the finger-like roots of the *api-api* and *piapi* mangroves are good examples. This protection, along with the abundant food supply that comes from mangrove leaves, make mangrove areas very good nurseries for many important sea animals. For every hectare of mangrove cut down, a corresponding reduction in fish catch is estimated at 1.08 tons per hectare per year.

- **Mangroves produce leaf litter and detrital matter, which are valuable sources of food for animals in estuaries and coastal waters.** The leaves that fall from a mangrove tree break up and decompose into small pieces known as detritus, some too small to be seen by the human eye (see Figure 1.2). The detritus is broken down by bacteria, fungi and other microorganisms that nourish marine animals. Mangroves contribute about 3.65 tons of litter per hectare per year.

- **Mangroves protect the environment by protecting coastal areas and communities from storm surges, waves, tidal currents and typhoons.** The crown and stem of mangroves serve as physical barriers. Their specialized roots trap and hold sediments and siltation from the uplands. Further, mangroves promote clear water and the growth of corals and seagrasses.

- **Mangroves produce organic biomass (carbon) and reduce organic pollution in nearshore areas by trapping or absorption.** Mangroves contribute 1,800-4,200 grams of carbon per square meter per year (approximating the contribution of the tropical rain forest and 10 times higher than primary production in the open ocean).

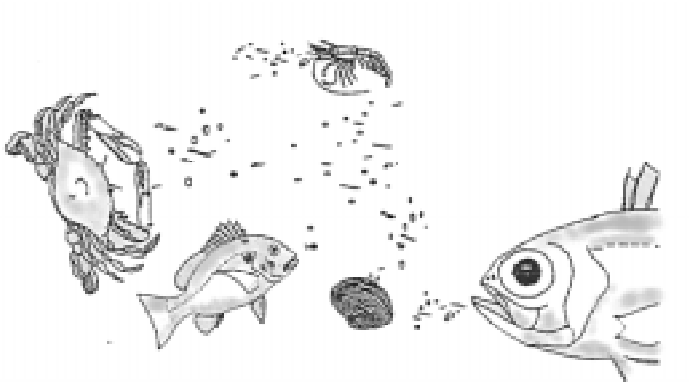


Figure 1.2 Fish, crabs, shrimps and shellfish are nourished by mangrove leaf detritus.

- **Mangroves serve as recreational grounds for bird watching and observation of other wildlife.** Mangroves provide shelter for local and migratory wildlife and serve as roosting and foraging grounds. They also provide access to highly diverse mangrove plants and animals and their adaptations, making them ideal ecological destinations and field laboratories for biology and ecology students and researchers.

- **Mangroves are a good source of wood and timber and *nipa* shingles for housing materials, firewood and charcoal, and of poles for fish traps. Mangrove seeds and propagules can be harvested and sold. Fish, crustaceans and mollusks can also be harvested from mangroves. Aquaculture and commercial fisheries also depend on mangroves for juvenile and mature fish species. Last but not the least, mangroves are sources of tannin, alcohol and medicine.**

Dixon (1989) estimates the value of a complete mangrove ecosystem to be in the range of US$500 to US$1,550 per hectare per year, the minimum valuation of a loss when mangroves are converted to other land use forms. White and Cruz-Trinidad (1998) use US$600 per hectare per year as the acceptable economic equivalent to indicate what is lost if mangroves are converted to other uses.

THREATS

Table 1.1 enumerates the various conditions that can cause damage to mangroves.

Some pests and diseases that destroy mangroves include: (1) barnacles which envelope stems of young *bakauan*, causing roots to rot; (2) tiny beetles (*Phoecilips fallax*) which attack propagules, thereby preventing them from germinating; the worm-like *Diopatra cuprea* which cause defoliation of leaves and seedlings; and crabs which girdle newly planted propagules and young seedlings.

From 1918 to 1970, an average of 3,100 hectares of mangrove were lost, increasing to 8,200 hectares from 1970 to 1985. These losses were mainly attributed to fishpond conversion.

Table 1.1. Threats to mangroves.

- *DIRECT (Human)*
  - Conversion of mangroves to fishponds and salt beds
  - Reclamation of mangrove areas for various developments (such as wharves, piers, airports, housing projects, etc.)
  - Pollution and siltation
  - Dikes and structures obstructing waterways and tidal inundation – this means that the tidal flow is prevented by these structures affecting nutrient distribution, salinity and temperature gradients, enhancing accumulation of biogas and other products of organic decomposition causing mangrove vegetation to die
  - Overexploitation/utilization
  - Disturbance due to gleaning, fish landing, etc.
- *INDIRECT (Natural phenomenon)*
  - Pests (diseases)
  - Typhoons
  - Sea level rise due to global warming causing polar ice cap to melt

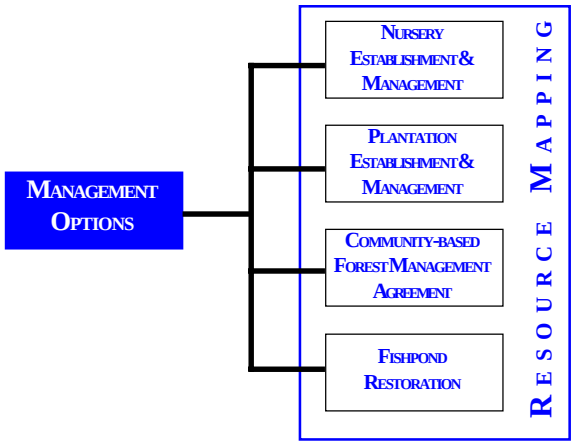
Currently, 95% of remaining mangroves are secondary growth and only 5% are old or primary mangroves mostly found in Palawan (Melana 1994). Mangrove forests remaining along Philippine coasts are of much lower quality than those found early in the century and cover less than one-third of the original area (White and Cruz-Trinidad 1998).

PROTECTION AND MANAGEMENT STRATEGIES

Table 1.2 presents strategies for the protection and management of mangroves.

MANAGEMENT OPTIONS

We suggest four management options for mangroves:



- **Mangrove nursery establishment and management**. Chapter 2 discusses the site selection, design, operation and management of nurseries for Philippine mangrove species. Nursery technologies ensure the availability of planting materials and the production of high quality seedlings.

- **Mangrove plantation establishment and management**. Chapter 3 provides information on developing and managing mangrove plantations and the remaining natural forest stand to maximize the benefit to the coastal ecosystem. The chapter also discusses mangrove

Table 1.2. Mangrove protection and management strategies.

1. Assignment of users or property rights

- Protected areas (under the Protected Area Management Board)
  - strict nature reserve
  - natural park
  - natural monument
  - wildlife sanctuary
  - protected landscapes and seascapes
  - resource reserve
  - natural biotic areas
  - other categories established by law, conventions or international agreements in which the Philippine Government is a signatory
- Contracts, permits and leases
  - Mangrove Stewardship Agreement (MSA)
  - Certificate of Stewardship Contract (CSC)
  - Community-Based Forest Management Agreement (CBFMA)
  - *Nipa* Lease Permit
  - Other Lawful Permit

2. Regulatory techniques

- Use of prohibitions
  - no illegal fishponds and conversion of mangroves
  - no mangrove cutting
- Utilization regulation based on affirmed resource use plan or based on use prescribed by government
- Exploitation limitations
  - close portions of mangrove areas from shell collection, boat docking, swimming, fry collection, etc.
  - compartmentalize mangrove areas to allow compatible uses in a rotation
- Enforcement of forest laws
  - needs to be coordinated and inter-/intra-participative (LGU, community, DENR and other entities)

3. Nonregulatory techniques

- Public education
  - seminars/workshops
  - meetings
  - video and slide shows
  - dialogues
  - publications on the importance of mangroves, alternative livelihood, sustainable development
- Training on mangrove rehabilitation and management, alternative livelihood, enterprise development, cooperatives
- Habitat enhancement/rehabilitation
  - mangrove reforestation
  - assisted natural regeneration
  - enrichment planting
  - restocking of diminishing species
- Research and monitoring
  - mangrove resource assessment
  - fishery assessment
  - growth and yield studies
  - socioeconomic profiling
  - citizen monitoring of livelihood projects
  - impact monitoring
- Community organizing
  - *bakauan* planters
  - fishers' associations
  - cooperatives
  - women's organizations
- Special and pilot projects
  - community coastal cleanup
  - waste management
  - food production
  - population control
- Alternative livelihood and other interventions
  - sea ranching/mariculture/polyculture
  - fishery
  - cottage industry
  - GO/NGO interventions (credit assistance, medical missions, etc.)

plantation objectives, plantation site identification/selection, choice of species to plant, and planning and design of the plantation. Nonregulatory techniques in Table 1.2 are especially relevant strategies in mangrove plantation planning.

- **Community-Based Forest Management Agreement (CBFMA)** is a production sharing agreement entered into between a community and the government to develop, utilize, manage and conserve a specific portion of the forestland, consistent with the principles of sustainable development pursuant to a Community Resource Management Framework (CRMF). The CRMF is a document that defines the terms and procedures for accessing, using and protecting natural resources within the CBFMA area. These terms and procedures are to be formulated by the community with the assistance of the DENR, LGU and other private entities.

  Chapter 4 enumerates the benefits that the CBFMA provides to a people's organization; the steps in the CBFMA application; and the work requirements of mangrove forest stewards. It also gives information on working with *barangay* (village) councils and *Sanggumiang Bayans* (SBs) (municipal councils) for assistance in the application for a CBFMA. Details are provided on developing resolutions, ordinances and letters of support which are requisites to obtaining a CBFMA. Suggestions are put forward on obtaining financial and other support from the local municipality of the people's organization.

- **Fishpond restoration.** Chapter 5 discusses another mangrove management alternative: modifying abandoned or illegal fishponds in CBFMA areas to harvest firewood, poles, shells, fish, crabs and to provide food and shelter to crabs, shrimp, shells and fish in coastal waters. Aquasilviculture, which is the conversion of a fishpond area into a site where mangroves can grow and fish can thrive, is suggested as a fishpond restoration strategy. Steps in restoring and modifying fishponds are enumerated in the chapter.

Resource mapping (Chapter 6) can support the four management alternatives suggested. You do not have to do it all the time but in most cases it might be a good idea to resource-map your mangrove area, especially if you are doing a CBFMA.

Aspects of Mangrove Management

All photos by Calixto E. Yao except as indicated

Bakauan bato plantation within the Olango Bird Sanctuary, Cebu.

In enhancement planting, horizontal branches of old trees are pruned to create an opening to permit sunlight enough to nourish young plants.

Traditional mudcrab traps.

Participants in a mangrove trainors training during a demonstration of bagging operation.

The Pangangan Mangrove Causeway in Bohol was planted by a student to protect the infrastructure from strong waves.

A portion of Paden's Pass, formerly Banacon Highway, Banacon Island, in Getafe, Bohol, in honor of the late Eugenio Paden, who started the most successful community-based mangrove rehabilitation in the Philippines (photo by Fer Esguerra).

Mangrove dwellers trying their luck on throw nets, Mabini, Bohol.

Dead standing *bakauan lalaki* after being enclosed with dike, an illegal fishpond, in contrast with the dense stand in the background.

Busain (Bruguiera gymnorrhiza) with its solitary (one per peduncle) bright red flower, Tandag, Surigao del Sur (photo by Didit Quebido).

Pagatpat (Sonneratia alba) and *pagatpat baye (Sonneratia ovata*, one of the unrecorded species in the Philippines) in contrast. The former has a cup-like calyx, upturned sepals and boomerang-shaped seeds; the latter has a flat calyx, sepals touching the fruit and corky, granular seeds.

Participatory Coastal Resource Assessment mangrove site assessment, Handumon, Handayan Island, Getafe, Bohol (photo by Toni Parras).

Community in action within the CBFMA area conducting pruning before enhancement planting.

Knee roots of *pototan (Bruguiera sexangula)*. *Busain, langarai, pototan lalaki, tangal* and *malatangal* are other species with the same aerial roots.

Boat load of *nipa* shingles from Cogtong Bay, Bohol for shipment to Leyte, where the cost of *nipa* is higher.

A typical mangrove nursery established by coastal barangays of Palompon, Leyte for mangrove projects, an offshoot of the training conducted by the Coastal Resource Management Project.